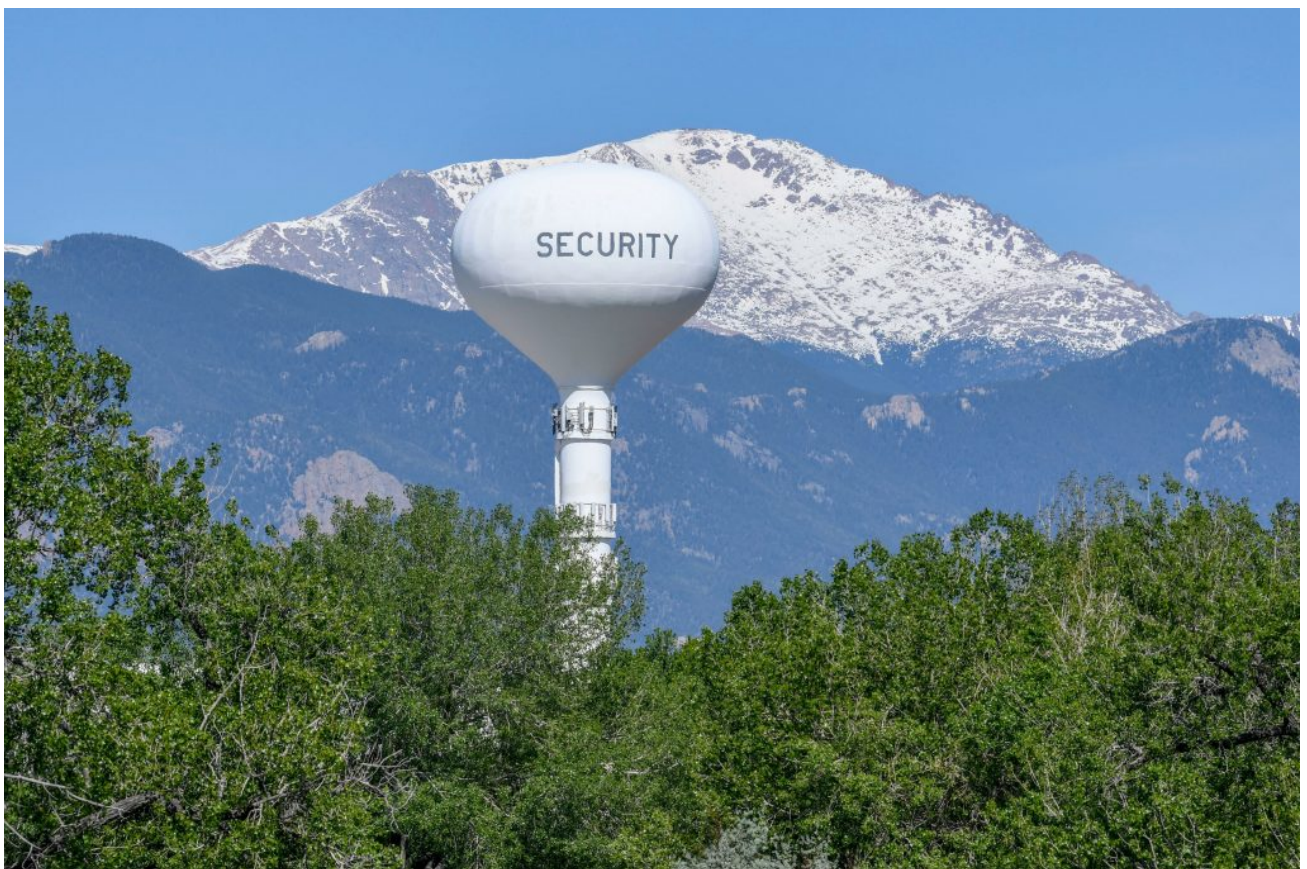


DRAFT

PFC/PFAS SAMPLING AND MITIGATION ACCIDENT PREVENTION PLAN SECURITY-WIDEFIELD, COLORADO



October 2018



DRAFT

**PFC/PFAS SAMPLING AND MITIGATION
ACCIDENT PREVENTION PLAN
SECURITY-WIDEFIELD, COLORADO**

OCTOBER 31, 2018

Prepared for:



United States Army Corps of Engineers – Omaha District
Contract W912DY-16-D-0026
Task Order W9128F18F0276



Air Force Civil Engineer Center



Peterson Air Force Base

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Accident Prevention Plan

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PFC/PFAS Sampling and Mitigation

Security-Widefield, CO

W912DY-16-D-0026, TO W9128F18F0276

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°C	degrees Celsius
°F	degrees Fahrenheit
AFB	Air Force Base
AFFF	aqueous fire-fighting foam
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
APR	Air-Purifying Respirator
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
cm	centimeter
CPR	cardiopulmonary resuscitation
CSP	Certified Safety Professional
EM	Engineering Manual
EMR	Experience Modification Rates
ERP	Emergency Response Plan
HAL	Health Advisory Level
HAZWOPER	Hazardous Waste Operation and Emergency Response
gpm	gallons per minute
IAQ	Indoor Air Quality
IX	ion exchange
kg	kilogram
lb	pound
µg/L	microgram per liter
NFPA	National Fire Protection Association
No.	number
OJT	on the job training
OSHA	Occupational Safety and Health Administration
PFAS	per- and poly-fluoroalkyl substances
PFC	perfluorinated compound
PFOS	perfluorooctanesulfonic acid
PFOA	perfluorooctanoic acid
PM	Project Manager
PPE	personal protective equipment
QC	quality control
RAC	Risk Assessment Code
SCBA	self-contained breathing apparatus

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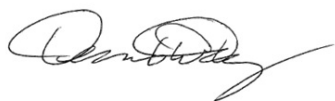
SDS	Safety Data Sheet
SH&E	Safety, Health and Environment
SHM	Safety and Health Manager
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSR	Subcontractor Safety Representative
SWD	Security Water District
TO	task order
URS	URS Group, Inc.
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WWSD	Widefield Water and Sanitation District

ACCIDENT PREVENTION PLAN
PFC/PFAS SAMPLING AND MITIGATION SECURITY-WIDEFIELD, COLORADO

Contract Number: W912DY-16-D-0026, Task Order
W9128F18F0276

Preparation Date: 1 November 2018

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Date

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PFAS Mitigation Design Project Manager

Date

This Accident Prevention Plan (APP) is valid for this specific project only. This APP is not to be used for other projects or subsequent phases of this project without the written approval of the URS Group, Inc. (URS) Safety and Health Manager (SHM). A copy of this plan is to be maintained on site by the Site Safety and Health Officer (SSHO) during the performance of field activities.

This APP, and each of its provisions, is applicable only to, and for use only by URS, its affiliates, and its subcontractors. Any use of this Plan by other parties, including, without limitation, third-party subcontractors on projects where URS is providing engineering, construction management, or similar services, without the express written permission of URS, will be at that party's sole risk, and URS will have no responsibility therefore. The existence and use of this Plan by URS will not be deemed an admission or evidence of any acceptance of any safety responsibility by URS for other parties unless such responsibility is expressly assumed in writing by URS in a specific project contract.

This APP outlines the safety and health procedures and equipment required for field activities to minimize the potential for field personnel to be exposed to danger. The health and safety guidelines and requirements are based on a review of available information and an evaluation of potential hazards for the specific project described herein. This APP is valid only for the specific project described herein. It is not to be used for other projects or subsequent phases of this project without the written approval of the URS SHM.

United States Army Corps of Engineers (USACE) Engineering Regulation 385-1-92 requires contractors to develop and implement an APP. If the project is a Hazardous Waste Operation, a Site Safety and Health Plan (SSHP) is required to be attached to the APP. Many required elements of the SSHP (**Attachment 3**) are addressed in the APP. Overlapping elements contained in the APP may not be duplicated in the SSHP; elements not duplicated will be referenced. This APP also meets the requirements of USACE Engineering Manual (EM) 385-1-1.

2.1 CONTRACTOR

URS is the prime contractor. URS Group, Inc., a subsidiary of AECOM, is the contract holder for this project. URS will have site safety and health oversight and coordination responsibilities for URS workers, including URS contractors and their subcontractors. Each contractor and subcontractor will be held accountable for the safe and healthful performance of work by each of their workers and subcontractors. URS will strictly adhere to the provisions of this APP, along with the applicable regulations issued by governmental entities.

- All workers and visitors on site are responsible for following the safety procedures regardless of their employ.
- URS will have site safety and health oversight and coordination responsibilities for workers.

2.2 CONTRACT NUMBER

USACE – Omaha District Contract Number (No.) W912DY-16-D-0026, Task Order (TO) No. W9128F18F0276.

2.3 PROJECT NAME

Perflourinated Compound (PFC)/Per- and Poly-flouroalkyl Substances (PFAS) Sampling and Mitigation TO for Security-Widefield, Colorado.

2.4 BRIEF PROJECT DESCRIPTION

Security-Widefield, Colorado is located in El Paso County, approximately 10 miles southeast of Colorado Springs (**Figures 2-1 and 2-2**). The area is mostly residential with some commercial property on or along United States highway 85-87.

2.4.1 Security, CO Site Overview

The Security site consists of groundwater contamination reported in water supply wells in the Security Water District (SWD) of El Paso County, Colorado. Security is a Colorado special district located in El Paso County, adjacent to the city of Colorado Springs. The district supplies drinking water to a population of approximately 19,000. The district has 24 existing supply wells that deliver groundwater into its water supply systems. There are 21 wells located along Route 85-87. Three wells are located southwest of the municipal airport near the French Elementary School.

In early 2016, the SWD learned that perflourooctanesulfonic acid (PFOS) and perflourooctanoic acid (PFOA) concentrations from four groundwater sources were greater than the United States Environmental Protection Agency (USEPA) 2009 provisional Health Advisory Levels (HALs).

Three of the groundwater sources were individual wells, and the fourth was a blend of groundwater from four wells. The provisional HALs for PFOS and PFOA were 0.2 micrograms per liter ($\mu\text{g/L}$) and 0.4 $\mu\text{g/L}$, respectively. To ensure that concentrations did not exceed these levels, the SWD shut down the seven wells with PFOS and PFOA concentrations greater than the provisional HALs. USEPA provisional HALs are developed to provide information in response to an urgent or rapidly developing situation. They reflect reasonable, health-based hazard concentrations above which action should be taken to reduce exposure to unregulated contaminants in drinking water.

In May 2016, the USEPA replaced the provisional HALs for PFOS and PFOA. The new HALs are 0.07 $\mu\text{g/L}$ for PFOS and PFOA individually and combined, which is much lower than the provisional values. The PFOS/PFOA concentrations in all water supply wells were greater than the new HALs. To ensure that its customers were not exposed to water with PFOS/PFOA concentrations greater than the 2016 HAL, the SWD:

- stopped producing drinking water from all 24 of its wells
- fast tracked new water mainline extensions to better supply all customers with surface water which is not contaminated with PFOS/PFOA or other perfluorinated compounds
- took delivery of water from the Southern Delivery System pipeline to replace water Security could not draw from the closed wells
- enacted voluntary, outdoor water restrictions during the summer, and other water conservation measures consistent with its Water Conservation Plan
- installed additional infrastructure to allow the SWD to take delivery of surface water from Colorado Springs Utilities to make up for water they could not draw from the closed wells
- maximized its surface water deliveries from the Fountain Valley Conduit and Southern Delivery System, including use of temporary excess capacity of the participants

Since groundwater is a less expensive water source than surface water, is necessary to meet long-term customer demands, and is a reliable source for managing peak use and drought conditions, it is important for the SWD to find a long-term solution that will allow it to resume.

The primary objective of this TO is to provide up to approximately 6,800 gpm of drinking water below the USEPA HAL of 0.07 $\mu\text{g/L}$ for combined concentrations of PFOS and PFOA. The USEPA HAL may be modified or replaced by Maximum Contaminant Levels (MCLs).

The remedy will treat water to the appropriate levels for PFOS and PFOA while meeting the flow rates, pressures, and chlorination necessary for water distribution to Security.

2.4.2 Widefield, CO Site Overview

The Widefield site consists of groundwater contamination reported in water supply wells operated by the Widefield Water and Sanitation District (WWSD). The WWSD service area is

located in El Paso County, Colorado adjacent to the city of Colorado Springs. WWSD supplies drinking water to approximately 19,000 customers. The district has historically obtained surface water from the Fountain Valley Authority, which operates a municipal water supply project that is part of the United States Bureau of Reclamation Fryingpan-Arkansas Project. Delivery of treated water to the project commenced in the early 1980s. Surface water from the Fountain Valley Authority is currently obtained from Pueblo Reservoir.

The PFOS/PFOA concentrations in all water supply wells were found to be greater than the 2016 USEPA HAL of 0.07 µg/L combined. To ensure that its customers were not exposed to water with PFOS/PFOA concentrations greater than the 2016 HAL, WWSD:

- stopped producing drinking water from all 10 of its active wells
- fast tracked new Ion Exchange water treatment facility to mitigate 3 of their 10 active wells
- enacted free water fill station for affected customers

Since groundwater is a less expensive water source than surface water, it is important for WWSD to find a long-term solution that will allow them to resume use of all of their groundwater supplies. In addition, WWSD groundwater rights are too valuable a resource not to be able to use and could potentially be lost to abandonment if not utilized.

One suspected source of PFAS in the Widefield aquifer is the run-off from the aqueous fire-fighting foam (AFFF) used at Peterson Air Force Base from the early 1970s until 1990 for training purposes as well as in actual fire situations. In 1990, the AFB moved the training to a lined basin to control the run-off from training exercises. The Widefield aquifer is downstream of the run-off from Peterson AFB. The Air Force completed a full site study at the base in October 2016, and presented a final report in July 2017.

WWSD has ten active water supply wells. Three wells (C1, C2, and C3) are capable of producing 1,800 gallons per minute (gpm) of raw water to the current Southmoor Water Treatment Plant Ion Exchange (IX) system, which is capable of treating up to 2,200 gpm. Two wells are being added to the Southmoor treatment plant (W3 and C36) through a USACE Rapid Response contract to supply enough water to reach full treatment capability, as well as add redundancy. WWSD is adding another 500 gpm plant treating W1 and W2 water supply wells. This plant located is expected to only operate in the growing season – May through October.

There are five additional wells in total (W4, E2, and W7 in addition to C36 and W3) requiring treatment. The well supply and distribution configuration will change depending on the location of the new treatment plant. Wells C1, C36, W3, E2, W7 and W4 will be piped to the new 3,300 gpm plant. For redundancy, the raw water header will be designed so that raw water from any well can be sent to either the Southmoor treatment plant or the new 3,300 gpm treatment plant. In addition, wells E2, W-7, C-36, W-3, W-4 and C-3 need to have new variable speed drives and well pumps installed to allow for better flow control to the treatment plants.

The current average nitrate concentration in the Widefield Aquifer is 6.8 milligrams per liter. If a Granular Activated Carbon system is off-line for a period time, nitrate concentrations will increase, which has previously concerned the state when completing the sampling. One of the reasons WWSD implemented the IX system was to reduce this potential problem. Widefield is utilizing an on-line nitrate monitor. The plant has never been down for longer than eight hours, which is the timeframe that triggers required state sampling for nitrates.

Widefield has the first full-scale IX system for PFAS treatment in the United States. The system uses two types of resin, one from Calgon called CalRes 2109 and a second from Evoqua called PSR2+. Both units are single use.

The primary objectives of this TO are to provide up to approximately 3,300 gpm of drinking water below the USEPA HAL of 0.07 µg/L for combined concentrations of PFOS and PFOA. The objectives will be met by installing a new remediation system (chlorination and distribution will have to be included in this system), providing redundancy for WWSD to route raw water to either the existing or the new treatment plant, and replacing existing pumps in specific wells with variable speed drives which will provide water in a more on-demand scenario.

The remedy will treat water to the appropriate levels for PFOS and PFOA while meeting the flow rates, pressures, and chlorination necessary for water distribution to WWSD.

2.5 SCOPE OF WORK

The scope of work will involve the design, construction, and implementation of:

- An IX water treatment facility, including all associated piping, utilities, etc., at the Little Johnson Reservoir site for the SWD in Security, CO (**Figure 2-1**).
- An IX water treatment facility, including all associated piping, utilities, etc., for the WWSD in Widefield, CO (**Figure 2-2**).

2.5.1 Phases of Work Anticipated

The following work activities have been identified for this project:

- Mobilization and Demobilization
- Utility Clearance/Site Inspection
- Directional Boring
- Excavation/Trenching - Heavy Equipment Operation
- Construction, Instrumentation Installation, Startup, and Operation
- Groundwater Sampling (Treatment System)
- Decontamination

- Site Restoration

Activity Hazard Assessments (AHAs) for work that will be completed as part of the field activities are included in **Attachment 1** of this plan and will remain accessible on the project site for viewing by all site personnel. Additional AHAs may be identified and added to this APP during the project period of performance.

2.5.2 Project Location

The work to be completed is located in the Security-Widefield, Colorado area as shown on **Figures 2-1** and **2-2**.

2.5.3 Equipment to Be Used

The work completed on this project will involve heavy equipment for excavation, trenching, and building construction using the following equipment.

- scrapers and scraper bowls
- bulldozers
- front end loaders
- excavators
- dump trucks
- drill rig (directional boring along and under roadways)
- construction equipment associated with building an on-slab water treatment building

2.5.4 Anticipated High Risk Activities

- ☐ **Low Risk** (*examples: non-intrusive work, occasional exposure and/or low risk hazards*)
- ☐ **Medium Risk** (*examples: intrusive work, heavy equipment use, frequent exposure and/or moderate hazards*)
- ☒ **High Risk** (*examples: complicated scope, large/ multiple work crews, and/or constant exposure to hazards*).

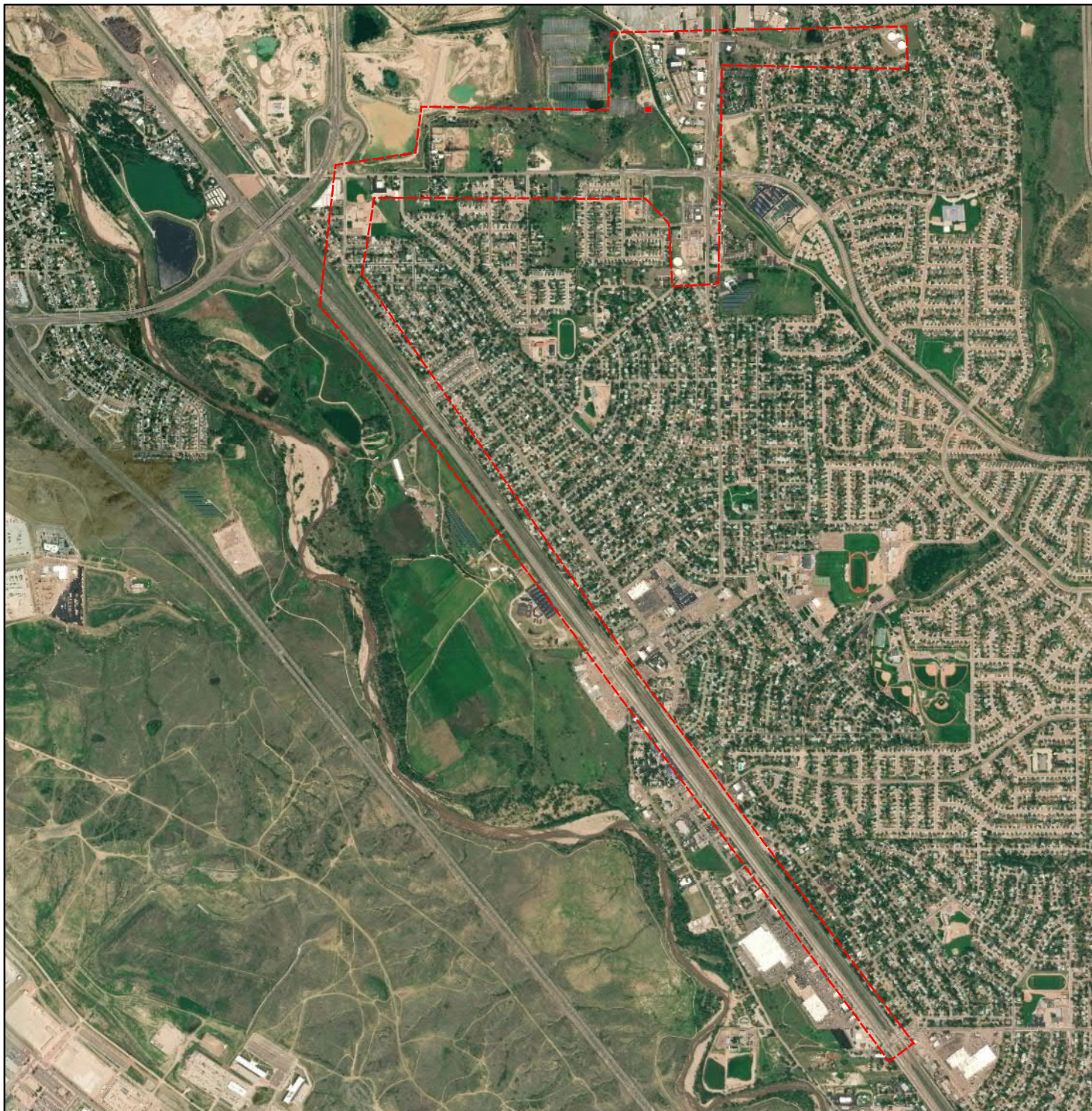
- | | |
|--|--|
| <input type="checkbox"/> Asbestos Removal / Contact | <input type="checkbox"/> Ordinance, Munitions, Explosives Use |
| <input type="checkbox"/> ATV Use | <input type="checkbox"/> Pile Driving |
| <input type="checkbox"/> Bridge / Dam Inspections/ Snooper Truck Use | <input type="checkbox"/> Radiation or Radioactive Instrument Use |
| <input type="checkbox"/> Confined Space | <input type="checkbox"/> Remote Location or Lone Worker |
| <input type="checkbox"/> Cranes and Rigging Use | <input type="checkbox"/> Respirator Use (does not include dust mask) |
| <input type="checkbox"/> Demolition | |

SECTION TWO

Background Information

- | | |
|--|--|
| <input type="checkbox"/> Diving – Scientific or Commercial | <input type="checkbox"/> Scaffolding Use |
| <input checked="" type="checkbox"/> High Speed Traffic Exposure | <input checked="" type="checkbox"/> Use or Exposure to Toxic Chemicals |
| <input checked="" type="checkbox"/> Hot Work | <input checked="" type="checkbox"/> Trenching / Excavation |
| <input type="checkbox"/> Conditions Immediately Dangerous to Life or Health (IDLH) | <input type="checkbox"/> Tunnel / Underground Work |
| <input type="checkbox"/> Laboratory Operations | <input type="checkbox"/> UXO / MMR |
| <input type="checkbox"/> LOTO or Live Energy Source Work | <input type="checkbox"/> Work at Heights >4 feet |
| <input type="checkbox"/> On-rail / Near Rail Work | <input type="checkbox"/> Work at Angle >30 deg. |
| | <input type="checkbox"/> Work On / Over Water |

Figure 2-1 Little Johnson Reservoir Water Treatment Plant Site Location



Legend

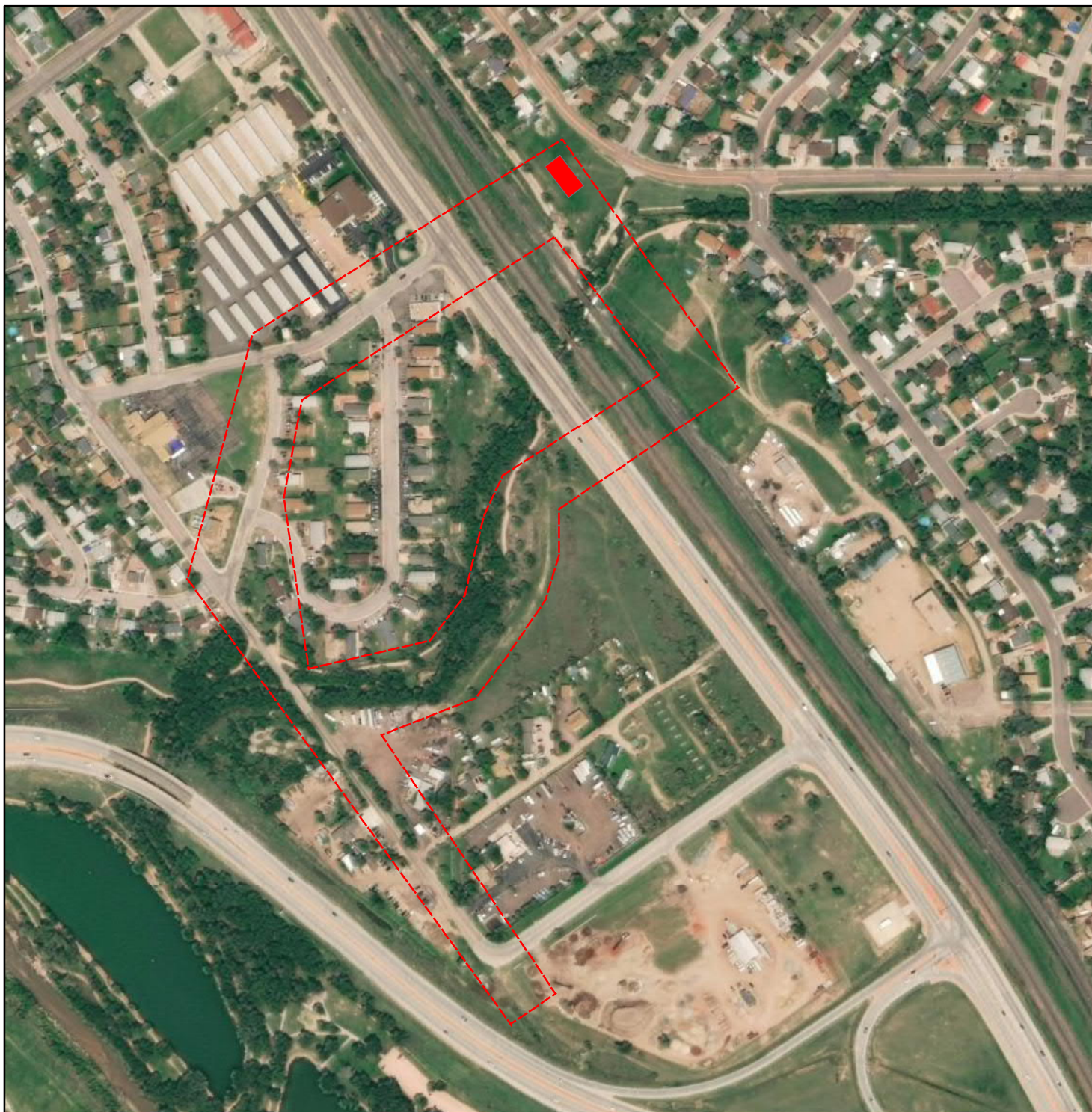
- Proposed Little Johnson Reservoir Water Treatment Plant
- Approximate Conveyance and Construction Work Area Boundary



Little Johnson Reservoir Water Treatment Plant Site Location Security, Colorado

Drawn By: DPG	Date: 10/19/2018	Project No: --	Figure 2-1
Checked By: DGG	Revision: 0		

Figure 2-2 Widefield Water Treatment Plant Site Location



Legend

- Proposed Water Treatment Plant
- Approximate Conveyance and Construction Work Area Boundary



400 200 0 400
Feet

Widefield Water Treatment Plant Site Location Security, Colorado

Drawn By: DPG	Date: 10/19/2018	Project No: --	Figure 2-2
Checked By: DGG	Revision: 0		

3.1 STATEMENT OF SAFETY AND HEALTH POLICY

URS Group, Inc., a subsidiary of AECOM, is the contract holder for this project. Following is the AECOM Safety, Health, and Environment Policy.

Safety, Health & Environment Policy

Purpose

This policy establishes the framework to attain best-in-class Safety, Health and Environmental (SH&E) performance in the interest of benefitting AECOM's employees and stakeholders in the global marketplace.

Policy

AECOM is committed to exceptional levels of performance in safeguarding our people and the environment as one of our Core Values. Keeping our people safe is our most important measure of success. We strive to be the beacon of safety excellence in the industries and global communities in which we work.

To advance our SH&E program, we are committed to:

- Zero work-related injuries to AECOM employees and protection of the environment as a result of our activities.
- Providing a highly effective SH&E management system that drives continual review and improvement.
- Meeting client requirements and properly incorporating all safety, health and environmental rules and regulations at the local, state, provincial and national levels.
- Developing an exceptional safety culture where our people embrace ownership for the safety of themselves and others.
- Advancing our goals of pollution prevention, resource conservation and environmental sustainability.
- Setting and meeting aggressive SH&E performance goals and Core Value Metrics to promote continuous improvement.
- Working with employees and business partners to continuously improve SH&E performance.
- Recognizing and celebrating those who contribute to excellent SH&E performance.
- Striving to make AECOM the provider of choice for the safe execution of design, build, finance, operate and maintenance work globally.

The commitment to this policy by the leadership, management and employees of AECOM provides the foundation for a safe workplace, operational excellence and long-term business success.

Expectations

Safety is a core value and a key to our success. We demand continuous improvement in our journey toward a "zero" incident culture, where everyone is committed to safety, health and environmental excellence.

To that end, we demand:

- Our leaders, managers, supervisors and employees demonstrate their commitment in their actions and decisions to assure that every person goes home safe every day.
- Our employees embrace safety as a core value both on and off the job.
- Each employee is committed to his/her own safety and that of his/her fellow employees.
- We will incorporate AECOM's Life-Preserving Principles into our work planning and execution.
- We proactively and aggressively identify, manage and eliminate hazards in the workplace.
- We train and prepare our people to have the knowledge, skills, competency and equipment required to work safely.
- We stop our employees from working if the work cannot be executed safely or if conditions or behaviors on the work activity are unsafe.
- All employees immediately report safety, health and/or environmental incidents, near-misses, unsafe conditions, and at-risk behaviors to their supervisor; and that we diligently work to correct the problem.

Our SH&E expectations will be accomplished by the demonstrated leadership of management, compliance with regulatory requirements and participation of AECOM personnel.

Review and Communication

This Policy will be reviewed annually to ensure it meets the needs of the company, and will be made available to all persons under the control of the company.



March 4, 2018

Michael S. Burke

Date

Chairman and Chief Executive Officer

3.2 SAFETY FOR LIFE



“Safety for Life” is a comprehensive integrated URS Safety Management System that drives our nearly 100,000 employees toward URS’s commitment to achieving zero work-related injuries and/or illnesses; preventing damage to property and the environment; and maintaining an environmentally friendly and sustainable workplace. Our Safety for Life program is supported by nine Life Preserving Principles that apply to all URS activities.

3.3 LIFE PRESERVING PRINCIPLES

Demonstrated Management Commitment

Our Executive, senior and project managers will lead the SH&E improvement process and continuously demonstrate support and commitment.

Employee Participation

Our employees will be encouraged and empowered to become actively engaged in our safety processes through their active participation in safety committees, training, audits, observations and inspections. Employees will be encouraged to participate in health initiatives and adopt a healthy lifestyle.

Budgeting and Staffing for Safety

Our safety staff will be competent, fully trained and qualified to provide technical resources to our internal and external clients. A budget to support safety activities will be included in project proposals.

Pre-Planning

Our design, engineering, project and construction management staff will deploy effective risk mitigation efforts to design, plan and build safety into every project. Pre-Project and Pre-Task planning will be an effective tool in protecting our employees and the environment.

Contractor Management

Our project staff will work closely with our sub-consultants, subcontractors, contractors and Joint Venture Partners to provide a safe work environment for employees and members of the public. Our goal of SH&E performance excellence will be equally shared by all project participants.

Recognition and Rewards

Our employees will be recognized for their efforts in working safely and their support of our safety efforts.

Safety Orientation and Training

Our employees will be provided with effective safety training in order to identify and mitigate hazards in the workplace to prevent injuries to themselves and others who may be affected by their actions.

Incident Investigation

Our managers and safety professionals will investigate all recordable incidents and serious near misses to identify contributing factors and root causes in order to prevent a reoccurrence. Lessons learned shall be identified, communicated and implemented.

Fit for Duty

Our employees are responsible to report to work each day fit for duty and not to pose a health and safety hazard to themselves or others.

3.4 FITNESS FOR DUTY

One of URS’s nine Life Preserving Principles is Fitness for Duty (see procedure S3AM-008 Fitness for Duty). Fitness for Duty means that individuals are in a state (physical, mental, and emotional) that enables them to perform assignments competently and in a manner that does not threaten the health and safety of themselves or others. On certain projects or for specific tasks,

fit for duty certifications may be requested of medical providers by SH&E Managers or Human Resources (HR). Employees should report to work fit for duty and unimpaired by substances or fatigue. Supervisors must observe their employees and work with the employee, SH&E staff, and HR to address deficiencies. URS will not tolerate retaliation against any employee for filing a complaint or concern regarding their fitness for duty or participating in any way in an investigation.

3.4.1 Medical Surveillance

The URS S3AM-128 Medical Screening and Surveillance, details the requirements to participate in a medical monitoring program. Medical Surveillance provides a streamlined process to determine if employees meet the physical requirements to perform assigned duties as defined by applicable regulations. It is also designed to provide a means to collect data relevant to exposure to chemical and physical agents for the protection of the workers and to confirm the effectiveness of health and safety programs. See Section 5 of the SSHP.

3.4.2 Proactive Health

URS is committed to promoting proactive health activities in addition to the planning for prevention of safety and environmental incidents. Proactive health activities will be completed on an on-going basis at URS on a corporate-wide basis (i.e. Wellness program associated with employee benefits), at offices, and at this project site. Management will be actively involved in providing and encouraging opportunities for health and wellness education and improvement. Health initiatives and education will be discussed periodically during office based meetings as the safety moment or during the daily tailgate meeting as a toolbox talk. Topics may be related to, but are not limited to:

- Heart health;
- Stress management;
- Smoking cessation;
- Diabetes prevention;
- Diet; and
- Exercise benefits.

Topics and educational materials can be located on the URS Wellness page, National Institutes of Health website, Centers for Disease Control and Prevention website and other reputable sources online.

In addition, the field team will be encouraged to participate in a daily stretch and flex routine (a standardized way to avoid soft tissue damage from work activities) to the best of their abilities, given their own personal limits. It is particularly beneficial to warm and loosen muscles before repetitive work, manual handling of loads, and when working in cold temperatures or with static postures.

3.4.3 Fatigue

One aspect of fit for duty is fatigue management. URS has developed procedures that limit work periods or requires additional rest under certain circumstances, including during long-distance travel or when working at high altitudes. These procedures also set limits on extended work periods of 14 hours per day or 60 hours per week. A fatigue management plan can be found in **Section 10.2** (see Procedure S3AM-009 Fatigue Management).

3.5 CONTRACTOR SAFETY COMMITMENT AND ACCIDENT EXPERIENCE

URS is committed to the goal of zero safety related incidents, and will continue to foster our belief that all injuries are preventable. Our core values and business principles will guide our efforts to provide the systems, tools, and processes that inspire our workers and subcontractors to embrace our aspirations, understand their personal responsibilities in achieving our goals, and exhibit the individual behaviors that are fundamental to our success.

URS serves a diverse client base and performs a wide range of services that inherently involve variable and unique risks and hazards. Key Safety, Health, and Environment (SH&E) metrics are part of business plans and are monitored and discussed among the management team on a monthly basis.

Experience Modification Rates (EMR) used by insurance carriers to determine past and future risks. The average EMR for a particular business is always one. An EMR less than one indicates a lower risk compared to others doing the same type of work. The following EMRs are provided from the National Council of Interstate Rates for URS.

- 2018 – EMR 0.55
- 2017 – EMR 0.52
- 2016 – EMR 0.53

3.6 PROJECT SAFETY GOALS AND BEHAVIOR BASED SAFETY

The goal of the URS Health and Safety Program is zero accidents; therefore, accident prevention continues to be of paramount importance to the firm. To this end, safety takes precedence over expediency. URS's goal for this project is that it be completed without a loss-day injury. URS is committed to compliance with all client health, safety, and environmental requirements as well as to applicable regulations.

Most accidents are due to unsafe behavior, and behavior changes may be made that significantly reduce accident risk. Contractor employees and subcontractors are expected to value safety and be responsible for their safety as well as the safety of others. The Safety and Health Manager (SHM) will provide clear safety expectations and provide positive and negative feedback for safe

and unsafe behavior. Peers are expected to intervene upon observation of an unsafe behavior and provide positive feedback for safe behavior.

The SSHO will maintain Form S3AM-007-FM1 - Behavior Based Safety Checklist modified for task-specific operations. Details of Behavior-Based Safety can be found in Procedure S3AM-007 Behavior Based Safety (**Attachment 2**). Safety observations will be performed by employees and subcontractor at the rate of 1 per 200 hours worked and a minimum of 1 per week of field work conducted. Each employee working on the project will complete a minimum of one safety observation.

3.7 REWARDS AND RECOGNITION

One of URS's Life Preserving Principles is Recognition and Rewards for proactive safety, health and environmentally focused behaviors. All projects are expected to participate in the rewards and recognition programs available on the Corporate and DCS Americas SH&E ecosystem pages. Large, long term projects are encouraged to establish a project specific rewards and recognition program which incorporates project specific goals and activities (S3AM-020 Recognition and Rewards). *All rewards and recognition programs must emphasize the 9 Life Preserving Principles and proactive SH&E activities NOT solely the achievement of lagging metrics ("injury/incident-free" hours, etc.) as those may discourage incident reporting.*

There are several possible appropriate methods of rewarding and recognizing employees and contractors:

1. **Informal** – recognition via verbal acknowledgment, email, spot awards, luncheons, etc.
2. **Formal** – Safety Star Award nomination
3. **Formal** – SH&E Challenge Coins (see local SH&E manager for details)

3.8 HAZARDOUS MATERIAL HANDLING AND WASTE MANAGEMENT

If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, and/or local regulations and SH&E Procedure S3AM-116 Hazardous Materials Shipping. A site-specific Entity Letter may be required for the site/client; if so, only persons named on the entity letter are allowed to sign waste shipping papers "on behalf of the USACE." Any individual signing shipping papers must have valid Department of Transportation and Resource Conservation and Recovery Act training for waste shipment. Consult the HZM/HZW & TDG page on ecosystem or the SH&E Manager for further guidance on URS and regulatory procedures and training requirements.

3.9 HOUSEKEEPING AND PERSONAL HYGIENE

Basic housekeeping requirements for offices and work sites, as well as personal hygiene and sanitation standards can be found in S3AM-013 Housekeeping. Inspections should be performed at the regular interval specified below. The form S3AM-013-FM1 - Housekeeping Inspection, is available for use.

Complete the table below regarding site-specific Housekeeping and Personal Hygiene requirements:

Housekeeping:	Inspection Frequency:	Daily	Inspector:	Ryan Dailey or designee
Eating, Drinking, Smoking:	Permitted only in designated area(s) located outside exclusion zone.			
Handwashing:	Water, soap and paper towels or equivalent supplies are located next to or within all toilet facilities. Site staff will wash hands and face after completing work activities and prior to breaks or meals.			
Toilets:	<p>Toilets are located at each water treatment plant construction site.</p> <p><i>NOTE: A minimum of one toilet must be provided for every 20 personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.</i></p>			
Water:	<p>Water is located at each water treatment plant construction site.</p> <p>A water supply meeting the following requirements will be utilized:</p> <p><i>Potable Water:</i> An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Disposable drinking cups for single use and a waste receptacle will be provided as needed. Water containers will be refilled daily and disinfected regularly. Potable water containers will be properly identified in order to distinguish them from non-potable water sources.</p> <p><i>Non-Potable Water:</i> Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating “Non-Potable Water, Not Intended for Drinking Water Consumption”</p>			
Illumination:	Illumination will not be provided. Natural light will be sufficient.			

3.10 LONE WORKER

Although lone worker situations are not likely to occur during this project, should they occur, the following procedures will be used. URS discourages employees from working alone (i.e., where URS personnel are out of visual and audio range of others) when performing field tasks (see SH&E Procedure S3AM-314 Working Alone). If lone work is to be performed, a communications/check-in plan must be developed and implemented using the table below.

Lone Worker (Name and phone number):	Example Worker Name, (555) 123-4567, URS Field Technician
Justification:	Treatment System Groundwater Sampling, System Operation and Maintenance
Check-In Requirement (Minimum is within 1 hour of end of each shift):	Check-in will occur within 1 hour of the end of each event. Lone worker will call or text the check-in contact. Verbal contact preferred.
Check-In Contact (Name, phone number, project title):	Bill Wemmert, (303) 740-3928 (office) or (303) 478-7343 (mobile), URS Project Manager
Hazard Summary (location of work and additional hazards):	Hazards include potential exposure to contaminated groundwater, sample preservative chemicals, and operational and maintenance hazards associated with water treatment plant operation (electrical, mechanical)
Response Plan (dispatch search team, call police, call hotel, etc.):	Attempts will be made to contact the lone worker. If there is no response, an on-site worker will be dispatched to check on the worker or emergency services will be notified, if necessary.

3.11 SAFETY OBSERVATIONS

Safety observations are observations made by employees or subcontractors of a condition or behavior which could contribute to an incident, prior to the incident occurring. Observations can also identify positive behaviors or interventions which contribute to the prevention of incidents. Large, long-term projects may benefit from the use of LifeGuard to track and trend observations on a site level. All other projects should log their observations using IndustrySafe. Both reporting systems can be accessed on any safety page of ecosystem. The QR codes below can be used while off the URS network from a smartphone/ device.



3.12 SHORT SERVICE EMPLOYEE

A Short Service Employee is an employee with fewer than 6 months experience working on field projects or an employee who has not completed the required training or received required certifications (see Procedure S3AM-015 Short Service Employee). The Project Manager will identify all Short Service Employees working on the project, and each Short Service Employee will be assigned to an experienced team member so all activities may be monitored. Short Service Employees shall be easily identified in the field environment, such as through wearing a specific colored hardhat, a manufacturer-approved orange stripe applied to their hardhat, or be clearly identified by some other system. Any new employee shall wear the designated Short Service Employee identifier until the Project Manager determines the employee has the knowledge, skills, and ability related to the specific hazard on the project.

3.13 STOP WORK AUTHORITY

URS empowers and expects all employees to exercise their Stop Work Authority (see Procedure S3AM-002 Stop Work Authority) if an incident appears imminent, or when hazardous behaviors or conditions are observed. A stop work request can be informal if the situation can be easily corrected, or may require shutting down operations if revised procedures are necessary to mitigate the hazard. If a URS employee observes an imminently hazardous situation on a site controlled by others (i.e., a client-managed contractor), the employee can always stop work for themselves by removing themselves from the situation. Employees also may attempt to stop work to avoid allowing the contractor to



come to harm by immediately notifying the contractor foreman or site engineer, or if necessary, the client or party managing the contractor.

No employee should object to the issuance of a stop-work request, nor can any disciplinary action be levied against the employee. All employees must agree that the situation has been mitigated before resuming work. No employee will be disciplined for refusing to work if they feel it is unsafe.

4.1 RESPONSIBILITIES

Roles and responsibilities for the project team are defined in SH&E Procedure S3AM-117 Hazardous Waste Operations. The Project Manager (PM) is ultimately responsible for the development of this APP and establishing a budget to implement the controls and training required. The Project Manager is also responsible for ensuring that the plan is implemented, that appropriate documentation is generated, and that records are maintained. The SH&E Manager is responsible for reviewing and approving this APP, and assisting with other SH&E matters upon request. A Site Safety Officer may be appointed to oversee implementation of the APP in the field. All project team members are responsible for reviewing and abiding by this APP, performing daily (or more frequent) task hazard assessments, stopping work when necessary to correct unsafe behaviors or conditions, and reporting incidents promptly to the PM and URS Incident Reporting Hotline (Incident Hotline 800-348-5046).

URS will have site safety and health oversight and coordination responsibilities for personnel. In accordance with S3AM-213 Subcontractor Management (**Attachment 2**), each subcontractor will be held accountable for the safe and healthful performance of work by each of their workers, subcontractors, or support personnel who may enter the site.

URS will strictly adhere to the provisions of the APP and applicable regulations issued by governmental entities. On-site workers are required to abide by the provisions of the APP, read the APP, and sign the Personnel Acknowledgement form (**Section 13**) prior to commencement of working on site. URS will provide a copy of the APP to each subcontractor to fulfill the requirements of 29 Code of Federal Regulations (CFR) 1910.1200 to inform subcontractors of site hazards. Each subcontractor will also provide proof of training (see **Section 6** for required training).

Changing and/or unanticipated site conditions may require modification of this APP in order to maintain a safe work environment. The SSHO may modify the plan and will record changes in the field logbook. Under no circumstances will modifications to this plan conflict with federal, state, or other governmental safety and health regulations. Any changes to this plan will be reviewed and approved by the SHM.

4.2 PERSONNEL RESPONSIBLE FOR SAFETY

4.2.1 URS Project Manager

The URS Project Manager (PM) has overall responsibility for completing the project in accordance with the contract and regulatory requirements, and is ultimately responsible for planning and implementing project tasks in a manner that ensures the safety/health of project workers and the quality of work. The URS PM will direct URS operations. The PM may delegate all or part of this duty to a properly qualified URS employee who is designated as the

Site Superintendent. At the job site, the PM or Site Superintendent, assisted by the SSHO, has the following primary responsibilities:

- Verifying that personnel, to whom this APP applies, including URS subcontractors, have received a copy of it, with ample opportunity to review the document and to ask questions.
- Establishing that field personnel are aware of the provisions of this APP, instructed in the work practices necessary to ensure safety, aware of the potential hazards associated with site operations, and familiar with procedures for dealing with emergencies.
- Providing the concurring SH&E Manager with updated information regarding conditions at the site and the scope of site work if changes occur that will affect the accuracy of this APP.
- Providing adequate authority and resources to the Site Superintendent or SSHO to allow for the successful implementation of all necessary SH&E Procedures.
- Maintaining regular communications with the Site Superintendent or SSHO and, when necessary, the URS Client SH&E Program Manager.
- Coordinating the activities of URS subcontractors and ensuring that they are aware of the pertinent health and safety requirements for these projects, when applicable.
- Conducting Safety System Auditing by way of Management Site Visits and/or Project Manager Self-Assessments on a regular basis.
- Approving amendments to the APP (in conjunction with the Site Superintendent or SSHO).
- Coordinating activities with the client as needed to ensure the safe implementation of this APP.
- Ensuring that appropriate personal protective equipment (PPE) and monitoring equipment is available and properly utilized by on-site workers.
- Establishing that on-site personnel have completed a minimum of 30 hours of OSHA safety and health training.
- Monitoring the safety performance of field personnel to confirm that the required work practices are employed.
- Ensuring that utility clearances are obtained prior to the start of work (SSHP – **Attachment 3**).
- Ensuring that the appropriate safety procedures (**Attachment 2**) are available on site.
- Correcting work practices or conditions that may result in injury or exposure to hazardous substances.
- Ensure the S3AM-004-FM1 - SH&E Incident Report and USACE Engineering Form (ENG) 3394 (**Attachment 4**) are completed.
- Ensuring that field personnel sign the Personnel Acknowledgement (**Section 13**).

- Stopping site operations, if necessary, in the event of an emergency or to correct unsafe work practices.

4.2.2 Site Superintendent

The Site Superintendent has the overall responsibility and authority to direct work operations at the job site according to the provided work plans and APP. The Site Superintendent will also confirm that field personnel conduct operations at the site in accordance with project specifications and in a systematic manner using proven operating methods and techniques. The Project Manager may act as the Site Superintendent while on site. The Site Superintendent's responsibilities include:

- Discussing deviations or drift from the work plan with the SSHO and PM.
- Discussing safety issues with the PM, SSHO, and field personnel.
- Assisting the SSHO with the development and implementation of corrective actions for site safety deficiencies.
- Assisting the SSHO with the implementation of this APP and ensuring compliance.
- Assisting the SSHO with inspections of the site for compliance with this APP and applicable SH&E Procedures.
- Reviewing AHAs with the field crew.
- Reporting incidents and ensuring incidents and observations are logged into Lifeguard or IndustrySafe.
- Verifying that all operations are in compliance with the requirements of this APP, and halting any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspending individuals from field activities for infractions against the APP pending consideration by the SSHO, the SHM, and the PM.
- Managing on-site manpower and equipment necessary to safely conduct the fieldwork.
- Coordinating on-site field activities to minimize impacts to productivity and to confirm compliance with the APP.
- Directly interfacing with and relaying safety and health concerns to the PM.
- Preparing and submitting a detailed accounting of activities performed each work day.

4.2.3 URS Safety and Health Manager

The SHM is the program and corporate safety and health manager and provides an independent management and assessment of the safety procedures employed on site. The SHM does not report directly to the PM. Project responsibilities include:

- Developing, maintaining, and overseeing implementation of the APP, and approving the APP by signature.
- Visiting the project as needed to audit the effectiveness of the APP.
- Remaining available for project emergencies or changes, and developing appropriate modifications to the APP if needed.
- Implementing safety and health training and medical surveillance monitoring.
- Evaluating occupational exposure monitoring/air sampling data and adjusting SSHP requirements as necessary.

4.2.4 URS Site Safety and Health Officer (SSHO)

The Site Safety & Health Officer (SSHO) supports the Site Superintendent in providing a safe work environment. Not all sites will have a designated SSHO; the decision should be made by the PM and SHM taking into consideration the complexity and risks of the scope of work. The Site Superintendent may act as the SSHO on sites without one.

The SSHO reports to the SHM and is responsible for implementing and enforcing the safety and health requirements detailed in the APP. Project responsibilities include:

- Being present during operations to implement the APP and monitor compliance with the safety measures contained in the APP. Updating the APP to reflect changes in site conditions or the scope of work. APP updates must be reviewed and approved by the SHM.
- Inspecting the site for compliance with this APP and the SH&E Procedures using the appropriate field audit inspection checklist found in IndustrySafe.
- Evaluating construction operational risks, hazards, and safety requirements.
- Coordinating with Site Superintendent to review AHAs with the work crew.
- Coordinating changes/modifications to the APP with the SHM and field team.
- Developing and implementing corrective action plans to eliminate or mitigate hazards.
- Maintaining the Personnel Acknowledgement for on-site personnel (**Section 13**).
- Maintaining an Inventory of Hazardous Materials and Safety Data Sheets (SDSs) for hazardous materials present on site, including materials brought on site by subcontractors (**Attachment 5**).
- Conducting and documenting daily safety inspections and weekly safety audits.
- Conducting project specific training, including an initial safety orientation meeting and daily safety meetings for site personnel. Document the safety meetings in the S3AM-209-FM5 - Daily Tailgate Meeting Form (**Attachment 4**).

- Checking that all site personnel and visitors have received the proper training, orientation and medical clearance prior to entering the site.
- Maintaining a Site Visitors Log.
- Maintaining copies of training at the project site.
- Establishing controlled work areas (as designated in this APP or other safety documentation).
- Facilitating or co-leading daily tailgate meetings and maintaining attendance logs and records.
- Coordinating with the SHM to identify personnel for whom special PPE, exposure monitoring, or work restrictions may be required.
- Reviewing protection needs throughout the project and informing the PM, Site Superintendent, and SHM of the need to upgrade/downgrade protection levels as appropriate.
- Ensuring that decontamination procedures described in the SSHP (**Attachment 3**) are followed.
- Investigating and documenting injuries, illnesses, accidents, incidents, and near-misses.
- Stopping site operations, if necessary, in the event of an emergency or to correct unsafe work practices.
- Determining emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Selecting an alternate SSHO by name and informing him/her of their duties, in the event that the SSHO must leave or is absent from the site.
- Temporarily suspending individuals from field activities for infractions against the APP pending consideration by the SH&E Manager and the Project Manager.

4.2.5 Field Personnel

Field personnel involved in site operations have the following responsibilities:

- Understanding and abiding by the SH&E Procedures specified in the APP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Signing the Personnel Acknowledgement (**Section 13**).
- Providing feedback to SH&E management for continuous improvement relating to omissions and modifications in the APP or other safety policies and procedures.
- Taking reasonable precautions to prevent injury to themselves and to their fellow workers.
- Performing only those tasks that they believe can be done safely.

- Immediately reporting accidents and/or unsafe conditions to the SSHO, URS Incident Reporting Hotline (1-800-348-5046), and Industry Safe. The SSHO will then report these accidents and/or unsafe conditions to the PM, Site Superintendent, and SHM.
- Implementing the procedures set forth in the APP and reporting deviations from the procedures described in the APP to the SSHO, who will then report these deviations to the PM, Site Superintendent, and SHM.
- Stopping work if there is doubt about how to safely perform a task or if unsafe acts or conditions are observed (including subcontractors or team contractors).
- Speaking up and refusing to work on any site or operation where the SH&E procedures specified in this APP or other safety policies are not being followed.
- Notifying the SSHO of special medical problems (e.g., allergies) that may affect on-site performance, who will then report this information to the PM, Site Superintendent, and SHM.

4.3 NAMES OF COMPETENT PERSONS AND QUALIFICATIONS

A competent person is an employee who, through education, training and experience, has knowledge of applicable regulatory requirements, is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

URS's S3AM-202 Competent Person Designation Procedure explains the roles, responsibilities and procedures of naming a competent person. Complete the table below and include a S3AM-202-FM1 - Competent Person Designation Form for each URS competent person (subcontractors to use an equivalent process). Blank forms are included in **Attachment 4** while completed forms along with resumes are included in **Attachment 6**.

These activities require a competent person. Mark all that apply and list the name of the person.

	Activity	Name of Person
<input checked="" type="checkbox"/>	Assured Equipment Grounding Conductor	To be determined
<input checked="" type="checkbox"/>	Concrete & Masonry Construction	To be determined
<input checked="" type="checkbox"/>	Control of Hazardous Energy (Lockout-Tagout)	To be determined
<input checked="" type="checkbox"/>	Electrical Wiring Design & Protections	To be determined
<input checked="" type="checkbox"/>	Elevated Work Platforms & Aerial Lifts	To be determined
<input checked="" type="checkbox"/>	Fall Protection	To be determined
<input checked="" type="checkbox"/>	Hearing Protection	To be determined
<input checked="" type="checkbox"/>	Heavy Equipment	To be determined
<input checked="" type="checkbox"/>	Material Hoists & Personnel Hoists	To be determined
<input checked="" type="checkbox"/>	Rigging Equipment	To be determined
<input checked="" type="checkbox"/>	Stairways & Ladders	To be determined
<input checked="" type="checkbox"/>	Steel Erection	To be determined
<input checked="" type="checkbox"/>	Trench & Excavations	To be determined
<input checked="" type="checkbox"/>	Welding & Cutting	To be determined

4.4 URS RISK MANAGEMENT PROCESS

For each definable feature of work, an AHA with a Risk Assessment Code (RAC) for the work activity will be prepared and discussed with personnel engaged in the activity in a job pre-brief presented by the SSHO. The AHA will define the activities being performed, identify the work sequences, specific hazards anticipated, site conditions, equipment, materials, and the control measures that will be implemented to eliminate or reduce each hazard to an acceptable level of risk. See **Section 11** of this APP for further information about URS's risk management process.

4.5 INITIAL PRE-ACTIVITY HAZARD ASSESSMENT

AHAs will be prepared before starting a definable feature of work, and the AHA will be discussed with field personnel prior to starting the work. See **Section 11** of this APP for the requirements for AHA.

4.6 NO WORK REQUIREMENTS

No work will be performed unless a designated Competent Person/SSHO is present on the job site. No worker is required to work at a job he or she believes or knows is not safe or healthful.

Every member of the workforce is responsible for prevention of unsafe acts, behaviors or conditions, consequently preventing harm to people, the environment and property. Every member of the workforce, including subcontractors, has the authority and obligation to stop work that he or she considers to be unsafe. The team will support anyone who exercises his or her "Stop Work" authority. No negative consequence will occur as a result of "Stop Work" actions. Currently S3AM-209 Risk Assessment & Management (**Attachment 2**), daily tailgate meetings,

and Behavior Based Safety training are the mechanisms used to communicate to all team members that they have the authority to Stop Work.

4.7 POLICY FOR NONCOMPLIANCE WITH SAFETY REQUIREMENTS

The policy for non-compliance with safety requirements contained in this APP may include progressive stages of disciplinary action, depending on the willfulness and seriousness of the non-compliance. The disciplinary action, at the sole discretion of URS, may include any or the following: oral warning, written warning and removal from the project. Any URS employee who willfully disregards URS or client safety standards, rules or requirements is subject to disciplinary action. Disciplinary actions of URS employees will be coordinated with Human Resources and will be documented in accordance with URS Human Resources policy.

4.8 LINES OF AUTHORITY

Figure 4-1 is a graphic presentation of the lines of authority for the URS team. **Table 4-1** lists contact information for URS safety team members. The lines of authority for this project include:

- The field personnel responsible for the work are responsible for immediately reporting unsafe or potentially hazardous conditions, incidents, and near misses to the SSHO.
- The SSHO will communicate with the Site Superintendent and report the issue to the SHM and PM.
- The PM will report the issue, depending on severity, to the USACE PM.

4.9 MANAGEMENT ACCOUNTABILITY FOR SAFETY

The URS PM, with the assistance of the SSHO, is responsible for managing, communicating, implementing and enforcing compliance with this APP. Safety audits and inspections are performed, and the results become a part of the PM's record. Safety and health constitute one of the key performance indicators by which project managers are judged. Project managers who fail to demonstrate a commitment to compliance with URS and client safety and health policies and procedures will be relieved of their responsibilities as a project manager.

Figure 4-1 Project Organizational Chart

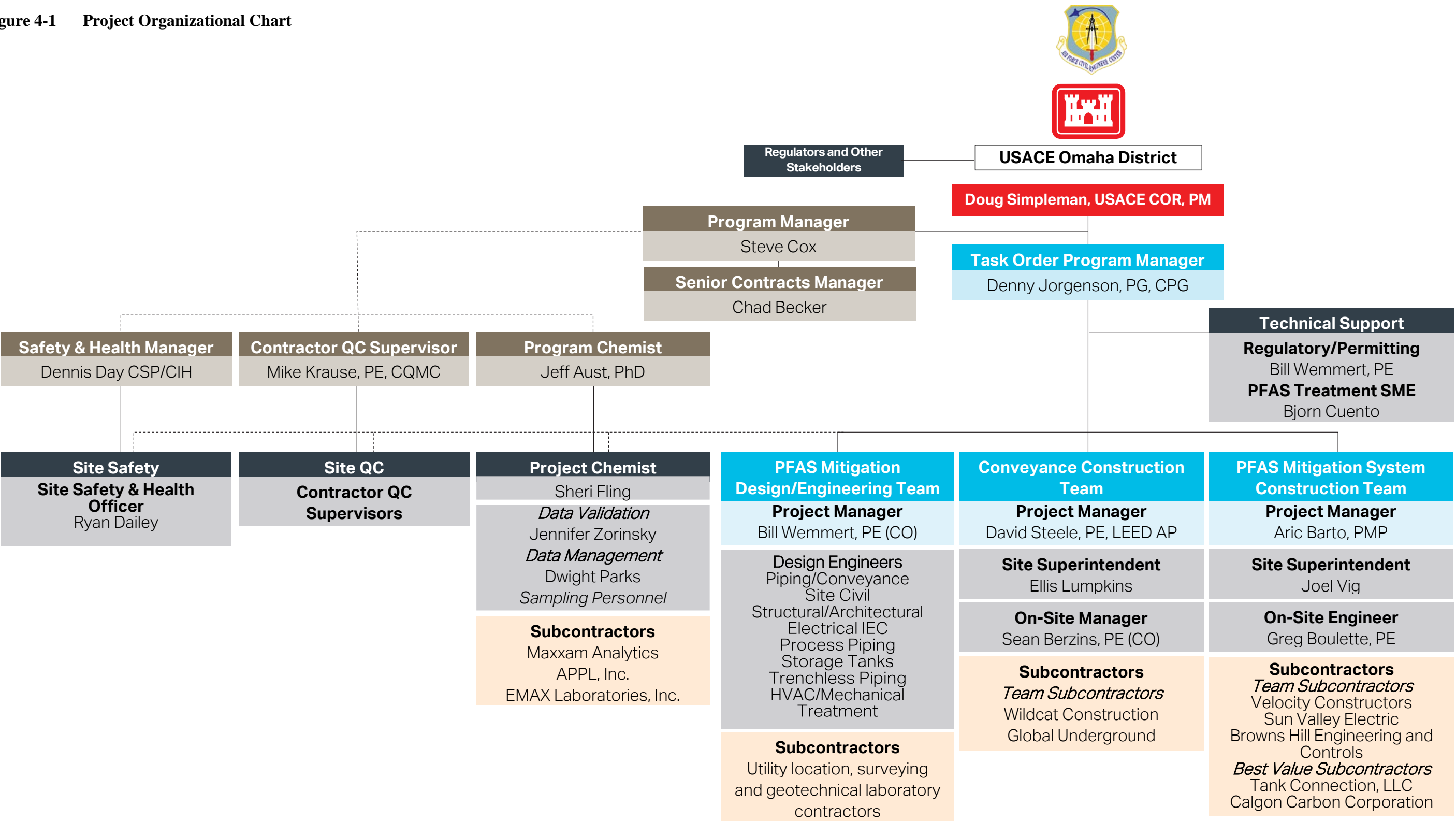


Table 4-1 Project Team Members

Organization	Name and Project Role	Telephone Number	E-mail Address
USACE	Doug Simpleman, COR, PM	(402) 995-2753	douglas.p.simpleman@usace.army.mil
USACE	TBD, Contracting Officer	TBD	TBD
URS	Steve Cox, Contract Program Manager	(402) 952-2542	steven.r.cox@aecom.com
URS	Denny Jorgenson, Task Order Program Manager	(402) 952-2546	denny.jorgenson@aecom.com
URS	Bill Wemmert, PFAS Mitigation Design PM	(303) 740-3928	bill.wemmert@aecom.com
URS	David Steele, Conveyance Construction PM	(315) 396-8919	david.steele1@aecom.com
URS	Aric Barto, PFAS Mitigation System Construction PM	(210) 241-4379	aric.barto@aecom.com
URS	Ryan Dailey, Site Safety and Health Officer	(303) 694-2770	ryan.dailey@aecom.com
URS	Sean Berzins, On-Site Engineer (Conveyance)	(303) 796-4693	sean.berzins@aecom.com
URS	Greg Boulette, On-Site Engineer (Construction)	(207) 541-2036	greg.boulette@aecom.com
URS	Mike Krause, Contractor Quality Control Supervisor	(402) 952-2519	michael.krause@aecom.com
URS	Jeff Aust, Program Chemist	(402) 952-2516	jeff.aust@aecom.com
URS	Bjorn Cuento, Treatment Systems Maintenance Engineer	(302) 781-5887	bjorn.cuento@aecom.com
URS	Sheri Fling, Project Chemist	(303) 740-3909	sheri.fling@aecom.com
URS	Jennifer Zorinsky, Data Validation	(402) 952-2563	jennifer.zorinsky@aecom.com
URS	Dwight Parks, Data Management	(303) 740-3811	dwight.parks@aecom.com
URS	Ellis Lumpkins, Site Superintendent	(407) 810-5741	ellis.lumpkins@aecom.com
URS	Joel Vig, Site Superintendent	(321) 229-9113	joel.vig@aecom.com
URS	Jerry Aldridge, Regional SHM	(979) 230-8039	jerry.aldridge@aecom.com
URS	Robert Sadowski, Area SHM	(248) 632-2376	robert.sadowski@aecom.com
URS	Dennis Day, CIH CSP, Safety and Health Manager	(402) 321-2961	dennis.day@aecom.com
URS	Martha Boss, CIH, CSP (Program SHM) Plan Approver	(402) 321-3029	martha.boss@aecom.com

Notes:

CIH = Certified Industrial Hygienist

COR = Contracting Officer Representative

PM = Project Manager

SHM = Safety and Health Manager, as defined in 385-1-1

URS = URS Group, Inc.

USACE = United States Army Corps of Engineers

5.1 IDENTIFICATION OF SUBCONTRACTORS AND SUPPLIERS

Subcontractors and vendors will be enlisted for the following services:

- Construction, logistics, and vehicle maintenance: Wildcat Construction, Sun Valley Electric, Velocity Plant Services
- Procurement, logistics, transportation, and construction services: Wildcat Construction, Sun Valley Electric, Velocity Plant Services
- Excavation/Trenching and Pipe Installation: Global Underground Corporation
- Installation/Startup of Water Treatment Plant Process and Instrumentation Equipment: Browns Hill Engineering and Controls
- Water Treatment Plant Process and Instrumentation Equipment Supplier: Calgon Carbon
- Chemical Analysis: Maxxam Analytics, Agriculture and Priority Pollutant Laboratories, and EMAX Laboratories, Inc.

The subcontractors for the following services are not known at this time, but additional information will be submitted to the APP for acceptance prior to the start of any activities listed.

- Surveying, drilling, tank connections, fencing, and other required services

5.2 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS AND SUPPLIERS

Each subcontractor will be held accountable for the safe and healthful performance of work by their workers. The requirements for subcontractor selection and subcontractor safety responsibilities are outlined in URS Procedure S3AM-213 Subcontractor Management. Each URS subcontractor is responsible for assigning specific work tasks to their employees. Each subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE) and all required training.

URS considers each subcontractor to be an expert in all aspects of the work operations for which they are tasked to provide, and each subcontractor is responsible for compliance with the regulatory requirements that pertain to those services as well as all other requirements applicable to their work. Each subcontractor is expected to perform its operations in accordance with its own unique safety policies and procedures, in order to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to URS for review prior to the start of on-site activities.

URS will provide a copy of the APP to each subcontractor in order to fulfill its obligation under 29 CFR 1910.1200 to inform subcontractors of site hazards. Subcontractors are required to read

this APP, sign the Personnel Acknowledgement (**Section 13**) before work activities begin, and abide by the provisions in the APP.

Hazards not listed in this APP but known to any subcontractor, or known to be associated with a subcontractor's services, must be identified and addressed to the URS Project Manager or the Site Superintendent prior to beginning work operations. The Site Superintendent or authorized representative has the authority to halt any subcontractor operations, and to remove any subcontractor or subcontractor employee from the site for failure to comply with established health and safety procedures or for operating in an unsafe manner.

Each subcontractor is required to designate a Subcontractor's Safety Representative (SSR) who meets the requirements of EM 385-1-1 Appendix A and is responsible for the safe and healthful performance of work by his/her work force and lower-tiered subcontractors. The SSR will be a competent person in regards to the specific work he/she is supervising. During subcontractor activities on site, the SSR will perform work area inspections and conduct safety meetings and safety orientations for new employees. The SSR will attend daily safety meetings with the SSHO. The SSR will also participate in investigations of accidents and overexposures involving subcontractor personnel.

Other safety responsibilities of subcontractors include:

- Maintain a copy of their company's safety and health plan/program (written or digital), which will be kept available for reference.
- Have access to a copy of EM 385-1-1 (written or digital).
- Check in at the field office prior to entering the construction site.
- Attend daily tailgate meetings regarding ongoing field operations and safety concerns.

Each subcontractor will provide:

- their subcontractor APP that complies with 29 CFR 1910.120 and addresses the activities of their employees relative to this project;
- training certifications for 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) and 8-hour HAZWOPER refresher training for personnel involved with field activities; and
- medical surveillance fitness for duty documentation for each employee.

5.3 VISITORS

Authorized visitors (e.g., client representatives, regulators, URS management staff) requiring entry to any work location on the site will be briefed by the PM, Site Superintendent, or SSHO on the hazards present at that location. Visitors will be escorted at all times at the work location and will be responsible for compliance with their employer's health and safety policies. In

addition, this APP specifies the minimum acceptable qualifications, training, and PPE that are required for entry to any controlled work area; visitors must comply with these requirements at all times.

If the site visitor requires entry to any exclusion zone (EZ), however does not comply with the above requirements: all work activities within the EZ must be suspended.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

All site personnel engaged in site activities are required to abide by these general safety training requirements. Refer to S3AM-003 SH&E Training for further information (**Attachment 2**).

- All personnel are required to remain current in all of their required training and evaluate their need for additional training when a change in work occurs. Administration and compliance with the requirements for additional task-specific training will be the responsibility of the PM.
- Safety training documentation will be reviewed by the SHM prior to the start of site work.
- Current copies of training certificates and statements of medical program participation for all personnel are maintained by the SSHO.
- A list of site personnel and their training certificates will be provided prior to the start of fieldwork and will be updated throughout the site activities.

6.1 APP/SITE ORIENTATION

The PM shall conduct a project/site-specific APP orientation prior to the start of field operations, with support as needed by the SHM, SSHO, or Site Superintendent. This meeting will involve representatives from all organizations with a direct contractual relationship with URS on the job site. Participants will then sign the APP Personnel Acknowledgement (**Section 13**).

6.2 REQUIREMENTS FOR SAFETY OCCUPATIONAL HEALTH ORIENTATION

Prior to the start of on-site operations, the SSHO will conduct a site safety orientation for field personnel. This meeting will involve representatives from all organizations with a direct contractual relationship with URS on the job site. This meeting will cover the following topics:

- contents of this APP and SSHP
- types of hazards at the site, health effects, and means for minimizing exposure to them
- types of monitoring that will be performed
- action levels for upgrade and downgrade of personal protective equipment (PPE)
- PPE that will be used
- site-specific respiratory protection requirements
- decontamination protocol
- site control measures, including safe operating practices and communication
- location and use of emergency equipment
- spill response
- evacuation signals and procedures

- emergency contacts
- the route to the nearest hospital

This orientation will allow field personnel to clarify any issues they do not understand, and will reinforce individual responsibilities regarding safety and health during site work. At the conclusion of this meeting, field personnel will sign a copy of the Personnel Acknowledgement Form, which is found in **Section 13**. The SSHO will maintain these agreements at the site, and place them in the project file at the conclusion of the operation.

6.3 VISITORS ORIENTATION

Visitors are required to complete an orientation appropriate to the site that will be visited, and subsequently abide by URS SH&E policies and procedures when visiting the site.

Visitors to URS premises or sites will be escorted by a URS employee who will confirm local security arrangements are applied and the visitor is aware of SH&E management requirements, including those for emergency response and incident reporting.

6.4 REQUIREMENTS FOR MANDATORY TRAINING AND CERTIFICATIONS

Site personnel engaged in site activities are required to abide by the general safety training requirements (refer to S3AM-003 SH&E Training in **Attachment 2**). Mandatory training and certifications are discussed in the following subsections. Required certifications will be maintained on site by the SSHO.

6.4.1 Excavation Training and Competency

An Excavation Competent Person, meeting the requirements as defined in the definitions of EM 385-1-1 and 29 CFR Part 1926 and designated in writing by the employer, will be responsible for the immediate supervision, implementation and monitoring of the excavation/trenching program. This person, through training, knowledge, and experience in excavation/trenching is capable of identifying, evaluating, and addressing existing and potential hazards and has the authority to take prompt corrective measures with regard to such hazards. The Excavation Competent Person will inspect open excavations and trenches daily.

6.4.2 Other Site-Specific Training

Specific training requirements for site activities will be identified in the AHAs. The SSHO is responsible to ensure that field personnel have the required training.

6.5 PROCEDURES FOR PERIODIC SAFETY TRAINING FOR SUPERVISORY AND EMPLOYEES

The SSHO will conduct daily site safety briefings (i.e., tailgate meetings) prior to the start of field activities. Briefings will also be conducted whenever new personnel report to the site. Attendance at the daily tailgate meeting is mandatory for all employees and subcontractors at the site contracted to URS. Simultaneous operations are encouraged to attend each other's tailgate meetings or at the very least the supervisors shall discuss the coordination of activities and associated hazards of each other's tasks.

The purpose of the safety briefings is to assist personnel in safely conducting the scheduled work activities. The briefings will include weather-related information, instructions for new operations to be conducted, and/or safe work practices. The briefings will also provide an opportunity to identify safety-related performance deficiencies noted during routine activities or during a safety audit. Any unsafe conditions or activities observed during the previous day will be discussed at the daily briefings.

An AHA will be completed as part of the safety briefing. Field personnel are required to attend the briefings and sign the S3AM-209-FM5 - Daily Tailgate Meeting Form and the S3AM-209-FM6 - Activity Hazard Assessment form. Truck drivers will attend an initial site briefing and will be notified of changes that could affect the execution of their duties, such as changes in the haul route, or slippery road conditions, and will be encouraged to report any unsafe conditions or activities to the SSHO at any time.

As part of the daily tailgate meeting, employees and subcontractors will be encouraged to voluntarily warm up and stretch select muscle groups to the best of their ability and within each person's individual limitations. Stretching is particularly beneficial to warm and loosen muscles before repetitive work, manual handling of loads, and when working in cold temperatures or with static postures.

6.6 WORKER TRAINING AND QUALIFICATIONS

All personnel at this site must be qualified and experienced to perform their assigned tasks. Procedure S3AM-003 SH&E Training establishes the general training requirements for URS employees. In addition, S3AM-117 Hazardous Waste Operations, explains the Hazardous Waste Operations and Emergency Response (HAZWOPER) training and S3AM-128 Medical Screening and Surveillance, details the medical surveillance requirements.

Check all required training on the table below. Verify training records of employees and subcontractors.

Site-Specific Training Requirements	
Training	Applies to
<input checked="" type="checkbox"/> APP Orientation	All Employees and Subcontractors

<input checked="" type="checkbox"/> HAZWOPER 40 –HR	On HAZWOPER sites, in EZ, exposed to hazardous contamination
<input checked="" type="checkbox"/> HAZWOPER Supervisor	Employees managing others in HAZWOPER activities
<input checked="" type="checkbox"/> Field Safety	Anyone visiting the field that does not require HAZWOPER
<input checked="" type="checkbox"/> Speak-Up/Listen Up	All Environmental Business Line Field Employees and Supervisors by end of FY2018
<input type="checkbox"/> Fit Test/ Respiratory Protection	Employees needing to wear respirators
<input type="checkbox"/> Hazardous Materials Shipping	Employee responsible for shipping HZM/HZW/DG and/or signing manifests
<input checked="" type="checkbox"/> Annual Medical Surveillance/ Clearance	Employees working in an exclusion zone and the regulatory required exposure limit <u>is</u> exceeded for 30 or more days a year
<input type="checkbox"/> Biennial Medical Surveillance/ Clearance	Working in an exclusion zone more than 30 days a year and the regulatory required exposure limit is <u>not</u> exceeded
<input checked="" type="checkbox"/> OSHA 10 hr. Construction	Employees working near heavy equipment
<input checked="" type="checkbox"/> OSHA 30 hr. Construction	Supervisor/SSHO overseeing work with heavy equipment

6.7 REQUIREMENTS FOR EMERGENCY RESPONSE TRAINING

Workers will be trained on the Emergency Response Plan (ERP) found in **Section 10.3** of the APP.

6.7.1 First Aid and CPR Training

The Site Superintendent and SSHO will have up-to-date training in first-aid and cardiopulmonary resuscitation (CPR) training from the American Red Cross, or the American Heart Association, or from an organization whose training adheres to the standards of the International Liaison Committee on Resuscitation (as stated in writing), or from a licensed physician. Classes will contain a hands-on component. The certificate(s) will state the date of issue and length of validity.

6.7.2 Spill Response

Field personnel will be trained in how to respond to an incidental spill or release. Refer to **Section 10.3.6** of this APP for more information on Spill Response.

6.8 REQUIREMENTS FOR HAZARDOUS WASTE AND EMERGENCY RESPONSE TRAINING

All URS personnel working within the EZ of the sites will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent
- Eight hours of annual refresher training for all personnel (as required)

- Eight hours of HAZWOPER supervisor training for managers directing work activities, whether these managers direct the work from the office, support zone, contamination reduction zone, or exclusion zone
- HAZWOPER supervisors will also have three days of prior documented work activity under the supervision of a trained and experienced HAZWOPER supervisor
- At all times, at least two of the field workers on-site will have current first aid and CPR certification

All URS site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all personnel will be maintained by the SSHO. A list of site personnel and their training certificates will be provided prior to the start of field work.

6.9 EQUIVALENT TRAINING

USACE EM 385-1-1 requires that the on-site safety representative meet the following criteria:

“...as a minimum, must have completed the 30-hour OSHA Construction safety class or as an equivalent, 30 hours of formal construction safety and health training covering the subjects of the OSHA 30-hour course [see Appendix A, paragraph 3.d.(3)] applicable to the work to be performed and given by qualified instructors.”

All designated URS SSHOs have received training that is equivalent to the 30 hours of formal construction safety training as applicable to the work to be performed (HAZWOPER work). Training received includes the following a) Initial 40-hour HAZWOPER training, b) 24-hour supervised On The Job (OJT) training, c) 8-hour HAZWOPER Site Supervisor training and d) 8-hour annual HAZWOPER Refresher training. The accumulation of these courses has covered the applicable subjects of the OSHA 30-hour course as listed below:

- OSH Act/General Duty Clause
- 29 CFR 1904, Recordkeeping
- Subpart C: General Safety and Health Provisions, Competent Person
- Subpart D: Occupational Health and Environmental Controls, Citations and Safety Programs
- Subpart E: PPE, types and requirements for use
- Subpart F: Understanding fire protection in the workplace
- Subpart K: Electrical

- Subpart M: Fall Protection
- Rigging, welding and cutting, scaffolding, excavations, concrete and masonry, demolition; health hazards in construction, materials handling, storage and disposal, hand and power tools, motor vehicles, mechanized equipment, marine operations, steel erection, stairways and ladders, confined spaces **OR any others that are applicable to the work being performed.**

All designated URS SSHOs maintain competency through 24 hours of formal safety and health related coursework every 4 years. This training requirement is met by attending the 8-hour annual HAZWOPER refresher training every year for a total of 32 hours of formal safety and health related coursework every 4 years.

All designated URS SSHOs meet the HAZWOPER training requirements as listed in Section 33 of EM 385-1-1 as listed below:

- 40-hour off-site hazardous waste site instruction. Off-site instruction complies with the 40-hour training requirements in OSHA standards 29 CFR 1910.120 and 29 CFR 1926.65.
- 3-days OJT. In addition to the classroom training, the training includes 3 days of OJT (in field) experience under the direct supervision of a trained, experienced supervisor.
- 8-hour annual HAZWOPER refresher training. Refresher training complies with the requirements in OSHA standards 29 CFR 1910.120 and 29 CFR 1926.65.
- Supervisory training. On-site supervisors comply with the 8-hour supervisory training requirements in OSHA standards 29 CFR 1910.120 and 29 CFR 1926.65.

Training specific to other sections EM 385-1-1 or OSHA standards applicable to site work and operations is provided to workers before on-site work begins.

URS has adopted an approach to hazard assessment and control that incorporates both qualitative and quantitative methods to identify hazards and the degree to which these hazards may impact employees and URS operations. See S3AM-209 Risk Assessment & Management, for details regarding URS's process. This approach involves the following:

7.1 SH&E PROCEDURES

All URS SH&E procedures, in their controlled copy version, are available on the internal SH&E Policy and Procedures ecosystem page. Programmatic procedures referenced in this document (for example SH&E Training) do not need to be printed for inclusion in this APP. Only procedures that are needed for field activity reference and application **MUST** be printed in full and included in this APP. The applicable field procedures checklist is in the following Physical Hazards subsection and procedures are included in **Attachment 2**.

7.2 PRE-ACTIVITY HAZARD ASSESSMENT

A pre-activity hazard assessment is to be developed for each discrete task planned as part of the project. This assessment lays out the steps of the job, potential hazards, and mitigation measures. Form S3AM-209-FM4 - Pre-Activity Hazard Assessment or a client required equivalent may be used. Pre-Activity Hazard Assessments are included in **Attachment 1**.

As a result of unanticipated work activities or changing conditions, additional Pre-Activity Hazard Assessments may be required. All additional Pre-Activity Hazard Assessments will be reviewed and approved by the SH&E Manager.

7.3 ACTIVITY HAZARD ASSESSMENT

The AHA is a handwritten field form which is based on "Stop and Think" as the first thing you do before starting work activities often paired with the daily tailgate meeting or work permit issuance. Not all risks can be anticipated in this APP or the pre-activity hazard assessment process; therefore, the AHA is used to assess, mitigate, and document the site-specific conditions and changes to the hazard profile prior to and throughout the work task. Proper implementation of the AHA program protects worker health and safety. A blank S3AM-209-FM6 - Activity Hazard Assessment form is included in **Attachment 4**. The AHA must be signed by all employees each day and initialed whenever a changed condition provokes a change in hazard controls.

7.3.1 Development

AHAs will be completed by URS and any subcontractor field crews/workers performing the work. The team (or person) responsible for the AHA will be competent in a formal process of hazard recognition.

7.3.2 Risk Ranking

The AHA defines the initial RAC for each step.

- For each task, a RAC will be determined and discussed with personnel engaged in the activity during the Daily AHA development meeting.
- The final risk is that which remains after controls have been applied.

7.3.3 Timing

No work will begin on a task until the AHA has been accepted by the URS contact addressing the project-specific hazards and the URS SH&E Manager; and reviewed on-site by all workers engaged in the activity.

The information from the AHA will be communicated to all staff on-site during safety briefings. Workers will have in their possession the current AHA that reflects current site conditions, personnel, equipment, and control measures, while the work is being performed.

If the person responsible for implementing control measures is not available to implement those measures, work must stop and the AHA must be revised.

7.3.4 Daily AHA

Prior to initiating work each day, the SSHO will perform a Daily AHA as part of the Daily Site Safety Briefing. The current conditions will be evaluated compared to conditions anticipated and hazards found in the applicable AHA for the activity (i.e., job or task) to be performed that day. If the current AHA does not adequately address unanticipated hazards, the AHA must be updated and approved by the SSHO and the SH&E Manager.

7.3.5 Management of Change

AHAs are living documents and are intended to be created in the field and updated (by the workers) as needed. The AHA will be regularly reviewed and modified as necessary to address the following:

- A review will be initiated if there are any changes in site conditions and/or operations. If the initial RAC increases due to a change made to the AHA by the workers, the AHA will be resubmitted for acceptance prior to work proceeding. Changes to or updates of an AHA that do not increase the RAC are not required to be resubmitted for acceptance.
- A review will also be initiated if there is a change of the competent person overseeing the work. If a new competent person (not on the original list) is added, the list will be updated (an administrative action not requiring an updated AHA). The new person will acknowledge in writing that he/she has reviewed the AHA and is familiar with current site safety issues.

Any proposed changes will be reviewed and approved by the SSHO and SH&E Manager, or designated representative, prior to their implementation per S3AM-215 Management of Change. The SSHO as delegated by the SH&E Manager will record changes on S3AM-215-FM1 - Management of Change Authorization Form.

7.3.6 Recordkeeping

Once the activity/task has been completed, the AHA will be available and kept on file on site for the length of the contract. AHAs will then be maintained in the project files for 50 years.

7.4 4-SIGHT

When preparing hazard assessments and throughout the day workers should use 4-Sight. This is a mental process through which workers ask themselves (and each other) four questions designed to effectively assess hazards. Using these questions during each task, especially those without formal pre-AHA or AHA, will help workers identify hazards and condition changes so that they can control them or stop work to seek assistance.

- 1) **What am I about to do?**
- 2) **What could go wrong?**
- 3) **What could be done to make it safer?**
- 4) **What have I done to communicate the hazards?**



7.5 SPEAK UP/LISTEN UP

All URS employees have a responsibility to help create the environment where the expectation is Safety For Life. Speak Up/Listen Up (SULU) is a technique to steward jobsite safety by utilizing 4-Sight as a basis for safety feedback conversations. SULU has two main parts:

- **Speak Up** where employees use three simple steps when providing feedback to others about unsafe acts:
 - Ask to discuss their hazard assessment or 4-Sight for the task
 - Get a commitment from the employee to apply the hazard controls and perform the task according to the accepted procedures
 - Follow up to ensure the employee is working safely
- **Listen Up** where employees use two simple steps when responding to safety feedback:
 - Listen – Focus on the message, not the messenger
 - Commit to performing the task the safer way

SULU conversations should happen consistently throughout the work day to create clear expectations of how work should be performed. All employees should recognize safe work behaviors in order to reinforce them and keep them going. An occasional correction is much more effective when employees are frequently encouraged and positively recognized for their

safe actions. Managers and supervisors should be having SULU conversations during site visits and ensure peer to peer and site supervisor to crew SULU conversations are being held.

7.5.1 Hazard Categories

Pre-AHAs and AHAs should include consideration of the following hazard categories when identifying hazards and task specific controls:

- biological
- chemical
- electrical
- gravity
- mechanical
- motion
- pressure
- noise
- radiation
- thermal



7.6 PHYSICAL HAZARDS

A physical hazard is a hazard that threatens the physical safety of an individual; contact with the hazard typically results in an injury. The following table summarizes the physical hazards or activities containing physical hazards present at the site and the associated procedures that address protection and prevention of harm.

All checked procedures **MUST** be included in **Attachment 2** for implementation and reference.

Check all applicable hazards/activities and add site specific description of the hazard.

	Hazard/ Activity <i>(note: text in this column links to procedure)</i>	Site Specific Description <i>[where, what phase of work, frequency, etc.]</i>	Applicable Procedure
<input type="checkbox"/>	Abrasive Blasting		S3AM-335
<input type="checkbox"/>	Aerial Work Platforms		S3AM-323
<input type="checkbox"/>	All-Terrain Vehicles		S3AM-319
<input type="checkbox"/>	Blasting and Explosives		S3AM-336
<input type="checkbox"/>	Bloodborne Pathogens		S3AM-111
<input type="checkbox"/>	Cofferdams		S3AM-344
<input checked="" type="checkbox"/>	Cold Stress		S3AM-112
<input checked="" type="checkbox"/>	Compressed Air Systems and Testing		S3AM-337
<input type="checkbox"/>	Compressed Gases		S3AM-114
<input checked="" type="checkbox"/>	Concrete Work		S3AM-338

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	Hazard/ Activity <i>(note: text in this column links to procedure)</i>	Site Specific Description <i>[where, what phase of work, frequency, etc.]</i>	Applicable Procedure
<input type="checkbox"/>	Confined Spaces		S3AM-301
<input type="checkbox"/>	Corrosive Reactive Materials		S3AM-125
<input checked="" type="checkbox"/>	Cranes and Lifting Devices	Laying conveyance piping and WTP construction	S3AM-310
<input type="checkbox"/>	Demolition		S3AM-339
<input type="checkbox"/>	Diving (scientific and commercial)		S3AM-334
<input checked="" type="checkbox"/>	Drilling, Boring & Direct Push Probing	Laying conveyance piping	S3AM-321
<input checked="" type="checkbox"/>	Electrical Safety	WTP construction	S3AM-302
<input checked="" type="checkbox"/>	Excavation	Laying conveyance piping	S3AM-303
<input checked="" type="checkbox"/>	Fall Protection	Laying conveyance piping and WTP construction	S3AM-304
<input checked="" type="checkbox"/>	Flammable and Combustible Liquids	Laying conveyance piping and WTP construction	S3AM-126
<input type="checkbox"/>	Gauge Source Radiation		S3AM-122
<input checked="" type="checkbox"/>	Hand and Power Tools	Laying conveyance piping and WTP construction	S3AM-305
<input checked="" type="checkbox"/>	Hazardous Waste Operations	Laying conveyance piping, WTP construction, and WTP sampling	S3AM-117
<input checked="" type="checkbox"/>	Heat Stress	Laying conveyance piping and WTP construction	S3AM-113
<input checked="" type="checkbox"/>	Heavy Equipment	Laying conveyance piping and WTP construction	S3AM-309
<input type="checkbox"/>	High Altitude		S3AM-124
<input checked="" type="checkbox"/>	Highway and Road Work	Laying conveyance piping	S3AM-306
<input type="checkbox"/>	Hoists Elevators and Conveyors		S3AM-343
<input checked="" type="checkbox"/>	Hot Work	Laying conveyance piping and WTP construction	S3AM-332
<input checked="" type="checkbox"/>	Ladders	WTP construction	S3AM-312
<input checked="" type="checkbox"/>	Lockout Tagout	Laying conveyance piping and WTP construction	S3AM-325
<input type="checkbox"/>	Machine Guarding Safe Work Practice		S3AM-326
<input type="checkbox"/>	Marine Safety and Vessel Operations		S3AM-333
<input type="checkbox"/>	Material Storage		S3AM-316
<input type="checkbox"/>	Mine Site Activities		S3AM-341
<input type="checkbox"/>	Mining Operations		S3AM-345
<input type="checkbox"/>	Non Ionizing Radiation		S3AM-121
<input checked="" type="checkbox"/>	Overhead Lines	Laying conveyance piping and WTP construction	S3AM-322
<input checked="" type="checkbox"/>	Powder-Actuated Tools	WTP construction	S3AM-327

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	Hazard/ Activity <i>(note: text in this column links to procedure)</i>	Site Specific Description <i>[where, what phase of work, frequency, etc.]</i>	Applicable Procedure
<input checked="" type="checkbox"/>	Powered Industrial Trucks	Laying conveyance piping and WTP construction	S3AM-324
<input type="checkbox"/>	Radiation		S3AM-120
<input checked="" type="checkbox"/>	Railroad Safety	Laying conveyance piping	S3AM-329
<input type="checkbox"/>	Respiratory Protection		S3AM-123
<input type="checkbox"/>	Scaffolding		S3AM-311
<input type="checkbox"/>	Steel Erection		S3AM-340
<input checked="" type="checkbox"/>	Temp. Floors, Stairs, Railings, Toe-boards	Laying conveyance piping and WTP construction	S3AM-342
<input checked="" type="checkbox"/>	Underground Utilities	Laying conveyance piping and WTP construction	S3AM-331
<input type="checkbox"/>	Underground Work		S3AM-330
<input checked="" type="checkbox"/>	Wildlife, Plants and Insects	Laying conveyance piping and WTP construction	S3AM-313
<input type="checkbox"/>	Working Alone		S3AM-314
<input type="checkbox"/>	Working On and Near Water		S3AM-315

7.7 POTENTIAL CHEMICAL HAZARDS

The chemicals in the table below are known or suspected to be present at the site.

Summary of Hazardous Properties of Contaminant Exposure Hazards

PEL: Permissible Exposure Limits

TLV: Threshold Limit Values

	Chemical Name	Media	Primary Routes of Exposure	PEL	TLV	IP electron volts (eV)
Metals	<input type="checkbox"/> Antimony	Soil	Dermal	0.5 mg/m ³	0.5 mg/m ³	n/a
	<input type="checkbox"/> Arsenic	Soil	Dermal	0.5 mg/m ³	0.2 mg/m ³	n/a
	<input type="checkbox"/> Barium	Soil	Dermal	0.5 mg/m ³	0.5 mg/m ³	n/a
	<input type="checkbox"/> Beryllium	Soil	Dermal	2 µg/m ³	0.05 µg/m ³	n/a
	<input type="checkbox"/> Cadmium	Soil	Dermal	0.005 mg/m ³	0.01 mg/m ³	n/a
	<input type="checkbox"/> Chromium III	Soil	Dermal	0.5 mg/m ³	0.5 mg/m ³	n/a
	<input type="checkbox"/> Chromium VI	Soil	Dermal	0.005 mg/m ³	0.005 mg/m ³	n/a
	<input type="checkbox"/> Cobalt	Soil	Dermal	0.1 mg/m ³	0.02 mg/m ³	n/a
	<input type="checkbox"/> Copper	Soil	Dermal	1.0 mg/m ³	1.0 mg/m ³	n/a
	<input type="checkbox"/> Lead	Soil	Dermal	0.05 mg/m ³	0.05 mg/m ³	n/a
	<input type="checkbox"/> Manganese	Soil	Dermal	5 mg/m ³	0.2 mg/m ³	n/a
	<input type="checkbox"/> Mercury	Soil	Dermal	0.1 mg/m ³	0.025 mg/m ³	n/a
	<input type="checkbox"/> Molybdenum soluble	Soil	Dermal	5 mg/m ³	0.5 mg/m ³	n/a
	<input type="checkbox"/> Nickel	Soil	Dermal	1 mg/m ³	0.5 mg/m ³	n/a
	<input type="checkbox"/> Selenium	Soil	Dermal	0.2 mg/m ³	0.2 mg/m ³	n/a
	<input type="checkbox"/> Silver	Soil	Dermal	0.01 mg/m ³	0.01 mg/m ³	n/a
	<input type="checkbox"/> Vanadium	Soil	Dermal	0.05 mg/m ³	0.05 mg/m ³	n/a
	<input type="checkbox"/> Zinc	Soil	Dermal	15 mg/m ³	10 mg/m ³	n/a

Accident Prevention Plan

PFC/PFAS Sampling and Mitigation

Security-Widefield, CO

W912DY-16-D-0026, TO W9128F18F0276

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		Chemical Name	Media	Primary Routes of Exposure	PEL	TLV	IP electron volts (eV)
Common Site COCs	<input type="checkbox"/>	Dust	Soil	Inhalation	15 mg/m ³	10 mg/m ³	n/a
	<input type="checkbox"/>	perfluorooctanoic acid	Groundwater	Dermal, Inhalation, Ingestion	Add Info	Add Info	n/a
	<input type="checkbox"/>	perfluorooctanesulfonic acid	Groundwater	Dermal, Inhalation, Ingestion	Add Info	Add Info	n/a

7.8 POTENTIAL EXPOSURE PATHWAYS

Occupational exposure to chemical hazards associated with the work activities could potentially occur by two primary routes (inhalation and skin contact) and one indirect route (incidental ingestion).

7.8.1 Inhalation

The primary risks associated with URS's scope of work pertain to potential exposure to airborne contaminants and explosion hazards. Constituents that potentially pose an occupational concern to employees by the inhalation route are carbon monoxide, hydrogen sulfide, methane, and volatile organic compounds. Air monitoring will be performed within the employee breathing zone to assess the need to implement appropriate control measures or stop work. In addition, air monitoring will be performed at the source to assess potential explosion hazards.

7.8.2 Skin Contact

Personnel handling residual product or waste and associated equipment may be exposed to chemical hazards by skin contact or adsorption. However, exposure is expected to be limited since workers will be required to wear appropriate PPE (i.e. appropriate work gloves, body clothing, and/or face shield).

7.8.3 Ingestion

Personnel handling residual product or waste and associated equipment, including project hazardous materials, may be exposed by incidental ingestion. Typically, this exposure occurs if proper PPE was not used or personal hygiene was not practiced. Personal protection against exposure via ingestion can be accomplished by performance of proper decontamination procedures when exiting contaminated work areas as well as using the correct PPE.

7.9 DECONTAMINATION

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities. Decontamination steps are

outlined in S3AM-117 Hazardous Waste Operations procedure. Some key elements are as follows:

- All persons and equipment entering the EZ shall be considered contaminated, and thus, must be properly decontaminated prior to exiting to clean areas of the site.
- Avoid reactions between the solutions and contaminated materials. Review the applicable SDS.
- All contaminated PPE and decontamination materials shall be contained, stored and disposed of in accordance with site-specific requirements determined by site management.
- Use caution while working around decontamination stations, including the decontamination pad, which may be a slip or trip hazard.
- Use disposable equipment when possible and practical.
- All employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of PPE required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors.
- All decontaminated equipment shall be visually inspected for contamination prior to leaving the Contaminant Reduction Zone (CRZ).

Decontamination Procedures & Equipment		
Procedure		Equipment Needed
Equipment Decontamination Procedures		
Type Equipment	Decontamination Solution	Procedure
Waste Handling for Decontamination		
Waste Streams/Products		Disposal Procedures

7.10 AIR MONITORING

Monitoring shall be performed within the work area on site in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Monitoring shall be in accordance with S3AM-127 Exposure Monitoring Procedure and specified in the work permit and/or Pre-AHAs for the tasks. Key elements of the procedure include:

- Calibration of monitoring equipment and/or daily bump tests to verify calibrations and confirm alarm function.
- Personal monitoring and result evaluation must be directed by a Certified Industrial Hygienist or Certified Safety Professional.

7.10.1 Real-Time Exposure Measurement/ Equipment

Monitoring shall be performed within the work area on site in order to detect the presence and relative levels of toxic substances. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Monitoring shall be conducted as specified in the work permit and Pre-AHAs as work is performed. All instrumentation need to be rated intrinsically safe to prevent fire or explosion.

Check which real-time monitoring equipment will be used and update the model type if needed:

	Instrument	Manufacturer/Model	Substances Detected
<input type="checkbox"/>	Photo Ionization Detector (PID)	RAE Systems mini-RAE Photovac Microtip HNu Model Hnu (min. 10.6 eV bulb)	<ul style="list-style-type: none"> • Petroleum hydrocarbons • Organic Solvents
<input type="checkbox"/>	Multi or 4 Gas Detectors	RAE Systems Multi-RAE	<ul style="list-style-type: none"> • Lower Explosive Limit • Oxygen • Carbon Monoxide • Hydrogen Sulfide
<input type="checkbox"/>	Combustible Gas Indicator (CGI) <i>May be combined with individual or multi-gas detectors.</i>		<ul style="list-style-type: none"> • Explosivity
<input checked="" type="checkbox"/>	Particulate Monitor	MIE Model PDM-3 mini-RAM	<ul style="list-style-type: none"> • Aerosols, mist, dust, and fumes
<input checked="" type="checkbox"/>	Personal Monitoring/ Badges	Personal Particulate Monitor	<ul style="list-style-type: none"> • Aerosols, mist, dust, and fumes

7.10.2 Health and Safety Action Levels

An action level is a point at which increased protection is required due to the concentration of contaminants in the work area or other environmental conditions. The concentration level (above background level) and the ability of the PPE to protect against that specific contaminant determine each action level. The action levels are based on concentrations in the breathing zone.

If ambient levels are measured which exceed the action levels in areas accessible to unprotected personnel, necessary control measures (barricades, warning signs, and mitigation actions to limit, etc.) must be implemented prior to commencing activities at the specific work area.

Personnel should also be able to upgrade or downgrade their level of protection with the concurrence of Site Supervisor or SSHO or the Safety Manager.

Reasons to Upgrade: to – Known or suspected presence of dermal hazards;
 – Occurrence or likely occurrence of gas, vapor, or dust emission; or

- Reasons to Downgrade:**
- Change in work task that will increase the exposure or potential exposure to hazardous materials.
 - New information indicating that the situation is less hazardous than was originally suspected;
 - Change in site conditions that decrease the potential hazard; or
 - Change in work task that will reduce exposure to hazardous materials.

7.10.3 Monitoring Procedures

The monitoring procedures shown below are general guidelines for sampling activities. A reading in excess of action level outlined below will require additional ventilation for 30 minutes, followed by re-monitoring.

Monitoring Procedures and Action Levels

Parameter	Zone Location and Monitoring Interval	Response Level	Response Activity
Dust not otherwise classified (total by aerosol monitor)	Breathing zone every 30 minutes during field activities where exposure to excessive dusts are possible	< 5 mg/m ³	Continue work in Level D and continue monitoring
		> 5 mg/m ³	Upgrade to Level C (P100 respirator cartridges), implement dust suppression measures; contact the Site Safety Officer & Site Supervisor.
		> 10 mg/m ³	Cease activities, implement more effective dust suppression measures; contact the Site Safety Officer & Site Supervisor.
Dust not otherwise classified (total by aerosol monitor)	Edge of Exclusion Zone, every 30 minutes during excavation activities	< 5 mg/m ³	Continue work in required PPE, monitor air, and implement engineering controls
		> 5 mg/m ³	Cease activities and contact the Site Safety Officer & Site Supervisor.

7.11 ENVIRONMENTAL IMPACT PREVENTION

URS strives to avoid or control environmental impacts from our operations through planning and implementation of best practices as well as preparing responses to react to environmental incidents. S3AM-204 Environmental Compliance procedure provides details on permitting and planning requirements.

	Potential Environmental Impact	Description of Hazard and Permit or Control Being Implemented
<input type="checkbox"/>	Air Emissions	
<input type="checkbox"/>	Hazardous Waste Management	
<input checked="" type="checkbox"/>	Storm Water Pollution	

<input type="checkbox"/>	Other:	
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7.12 SITE CONTROL

The purpose of site control is to protect the public from inadvertently coming into contact with site hazards and to protect URS employees being impacted by hazards. This section details the equipment and actions needed to promote optimal site control.

7.12.1 Site Work Zones

Site layout and site control need to be coordinated achieve a productive work environment and efficient work process while minimizing exposure of employees and the public to hazards associated with the work. Consider the following items when planning the site layout and controls:

- “Line of Fire” hazards- overhead utilities, falling/ tipping equipment, release of energy/ pressure, flying debris,
- Noise, dust, odor suppression
- Contamination containment and decontamination area layout
- Traffic control for site vehicles/ equipment (public traffic control requires Traffic control Plan)
- Restricted access for areas requiring special training, skills, or certifications
- Restriction of work near railroads
- Presence or creation of excavations
- Loading/unloading areas
- Portable restrooms
- Dumpsters and bins
- Equipment lay down
- Heavy equipment parking
- Overnight safety and security needs

Check the description of the site controls **already** in place:

- ☐ Work area is within a facility/ property with secure and restricted access provided by client or third party
- ☐ Work area is enclosed within facility/ property but access is not restricted via locks, guards, or gates
- ☒ Work area is on a property that is open and access by the public is likely

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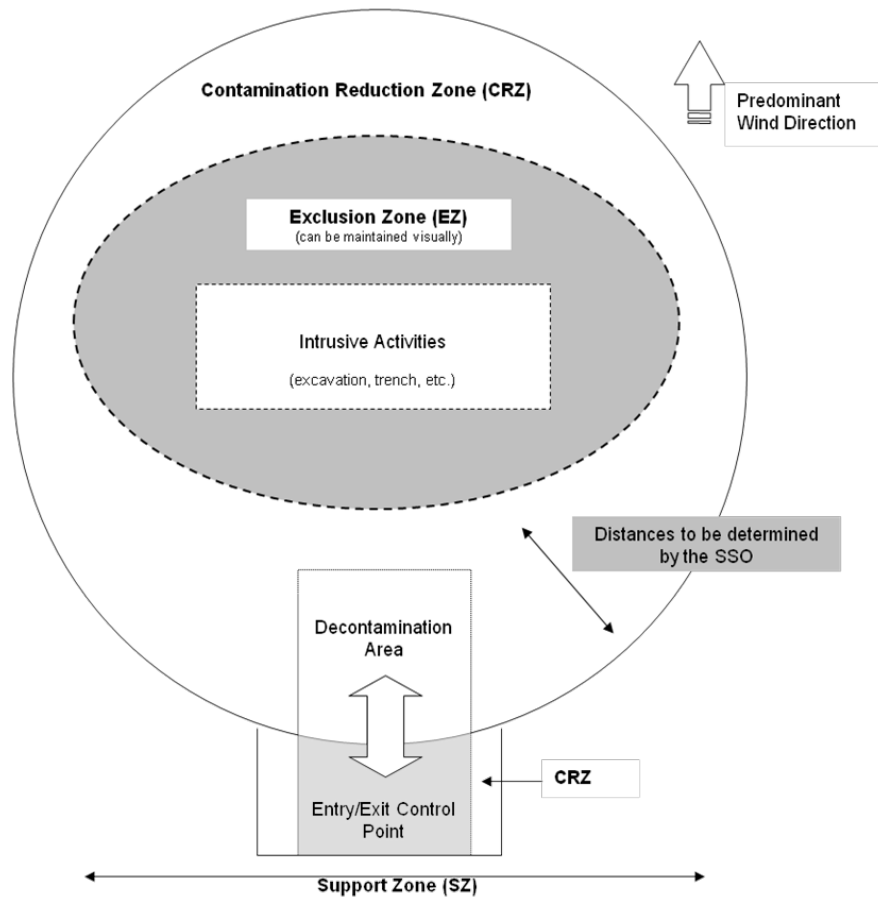
Hazard Assessment and Control

- ☐ Work area is on a property that is open but access by the public is unlikely
- ☒ Work area is in a roadway or right of way of a roadway (Traffic Control Plan required S3AM-306 Highway and Road Work)
- ☒ Work area is on or near railroad (including right of way, active lines, and crossings)
- ☐ Other: *(describe)*

Check and describe the site controls that need to be added to protect the public and the URS work team.

	Control Item	Description of Type and Application
<input checked="" type="checkbox"/>	Fence	
<input type="checkbox"/>	Locks	
<input checked="" type="checkbox"/>	Barricades	
<input checked="" type="checkbox"/>	Cones	
<input type="checkbox"/>	Tape	
<input type="checkbox"/>	Hole Covers	
<input type="checkbox"/>	Other:	

7.12.2 Site Control Map/ Diagram



7.12.3 Simultaneous and Neighboring Operations

Simultaneous and neighboring operations present a need for added coordination and communication to address hazards that are presented by multiple operations.

	Activity/ Company	Hazard	Controls/Mitigations and Communication Methods
Simultaneous Operation (within the site)	N/A		
Neighboring Operation (outside/ bordering the site)	N/A		

7.12.4 Site Security

All projects should be reviewed for the potential for personal security issues (e.g., assault, robbery, threat, etc.). Check all of the following that apply:

- ☐ Project site located in a higher crime area or has a history of security incidents
- ☐ Working outside of regular cellular telephone service
- ☐ Idle property with potential for trespasser(s) to shelter in buildings/structures and assault personnel
- ☐ Working at night

Detail the security measures to address the above risks: N/A

7.12.5 Operational Security Plans

All facilities maintained by URS must maintain an Operational Security Plan (OSP) describing the conditions of the site or facility, and identifying basic emergency response procedures. This requirement applies to field trailers maintained by URS for use on project sites. A blank OSP template is available in Global Resilience Group Standard [GRG-001-RP4](#). The OSP must be maintained by the Project Manager at the field trailer and a copy provided to the Global Resilience Group, which can be found on [Ecosystem](#).

8.1 DAILY SAFETY AND HEALTH INSPECTIONS

8.1.1 Safety Inspection Personnel

Daily inspections will be conducted by the SSHO. Safety and health audits may be conducted by the SHM, Regional SHM or Area SHM.

8.1.2 Proof of Inspector's Training

The SSHO for this project is Ryan Dailey. The Site Superintendent may substitute for the SSHO in the event of absence due to illness, etc.

8.1.3 Inspection Timing

Table 8-1 lists the general inspection requirements for this project. Additional specific inspection requirements may be necessary and will be included in the AHAs.

Table 8-1 General Inspection Requirements

What	Who	When	Documentation
Site housekeeping and perimeter	SSHO or designee	Daily	Form, see Section 8.1.4
Hand tools	Users	Daily	Tag and remove defective items from service
Heavy equipment and construction vehicles	Users	Daily	Form, see Section 8.1.4
Flammable/hazardous materials	SSHO	Daily	Form, see Section 8.1.4
First aid kit and emergency equipment	SSHO	Weekly	Form, see Section 8.1.4
PPE and monitoring equipment	SSHO	Daily	Form, see Section 8.1.4

8.1.4 Inspection Documentation

Safety and equipment inspection will be documented and documentation will be maintained on site using appropriate forms, listed below:

- Form S3AM-216-FM1 - Site Inspection Form
- Form S3AM-012-FM1 - First Aid Kit/AED Inventory and Inspection
- Form S3AM-306-FM1 - Equipment Checklist (Heavy Equipment)
- Form S3AM-309-FM13 - Heavy Equipment Inspection Report

- Form S3AM-126-FM1 - Flammable and Combustibles Inspection
- Form S3AM-005-FM2 - Vehicle Inspection Checklist
- Form S3AM-208-FM2 - Personal Protective Equipment Inspection

8.1.5 Inspection Deficiency Tracking and Follow-up

Corrective action will be immediately initiated by the URS Site Superintendent or SSHO. These corrective actions will be documented in writing and maintained on site for the duration of the project. Findings that represent deficiencies in the implementation of the APP, EM 385-1-1, or the subcontractor's accepted safety documentation, and which cannot be corrected immediately, will be added to the Tracking Log which will be posted in the field office and updated on a daily basis.

In most cases, deficiencies will be fixed immediately when found. The defective part will be replaced or the procedure will be corrected. If the deficiency is not immediately correctable, the task is shut down until the deficiency is corrected. Deficiencies will be discussed with subcontractors, and the subcontractor will be responsible for prompt repair, replacement or correction of any deficiencies that are not correctable immediately.

If any accident or incident should occur, the SSHO is required to complete an Accident/Incident Investigation Report which is reviewed by SHM, ASHM, and RSHM. In that report there is specific Accident Cause Analysis for identifying the problem and methods for correcting the deficiency. Any accidents, regardless of nature, will be reported to the USACE Safety Officer immediately.

8.2 EXTERNAL INSPECTIONS AND CERTIFICATIONS

No known external organization inspections or certifications are required. If an outside agency such as OSHA or EPA conducts an inspection or audit the Site Manager will notify the SHM, PM, Regional SHM, or Area SHM, and USACE. Documentation provided by the agency will be maintained.

In the event an OSHA inspection team visits the work site, URS will follow the procedures below:

- Check credentials of the OSHA team member(s);
- Provide an in-briefing/safety briefing to the OSHA team;
- OSHA personnel will be required to wear appropriate PPE before visiting the work site;
- Project personnel will be courteous during the visit and give OSHA personnel the necessary assistance;
- USACE Safety Office will be notified of the OSHA visit; and

- Notify the USACE PM of any findings of noncompliance or non-conformance rendered by the OSHA team.

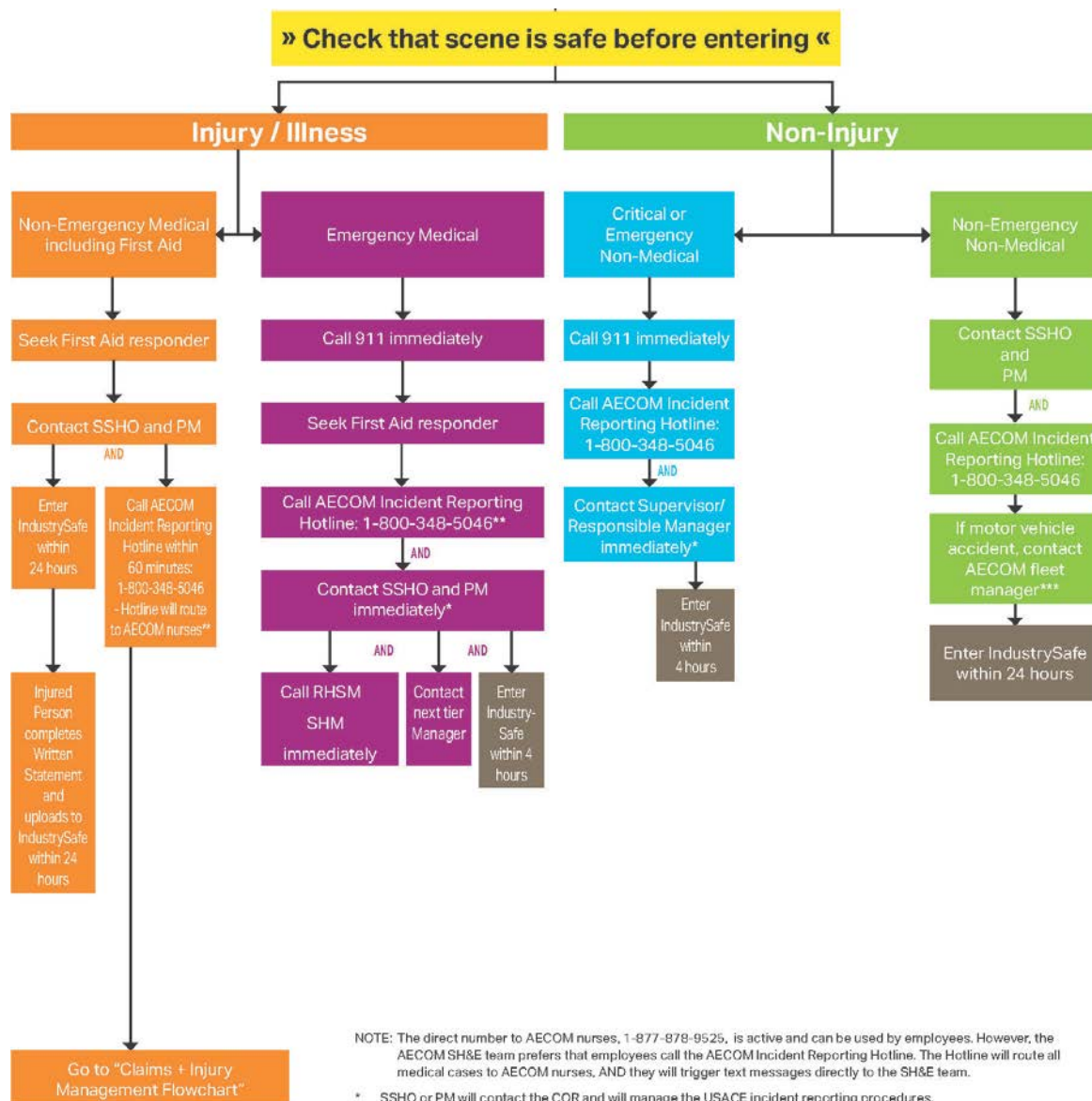
Complete/Submit an Inspection entry in IndustrySafe of the visit with 24 hours.

9.1 EXPOSURE DATA

The Exposure Report, (a tabulation of field labor hours, lost workday accidents, and number of lost workdays) will be completed by the PM and submitted annually to the USACE Contracting Officers Representative (COR).

9.2 MISHAP INVESTIGATIONS AND REPORTS

A “mishap” is defined to include an incident, accident, occupational illness, or near miss. Site workers are required to report work-related mishaps immediately to the SSHO. Follow the flow chart below in the event of a mishap.



9.3 USACE ENG 3394 VERSION 2

The SSHO will report mishaps that include injury that results in lost time; and/or property/equipment damage greater than \$2,000, using USACE ENG 3394 Version 2 Accident Investigation Report (**Attachment 4**). The PM will verbally notify the USACE Authorized Representative of an incident within 24 hours, and a written report will be submitted on USACE ENG 3394 Version 2.

Information on the USACE ENG 3394 form will include the contractor/subcontractor name, contract title, type of contract, name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known; and a brief description of accident (to include type of construction equipment used, PPE used). The conditions and evidence will be preserved at the accident site until the government investigation team arrives on site and a government investigation is completed.

10.1 PERSONAL PROTECTIVE EQUIPMENT

PPE is considered the last line of defense in hazard control. PPE is meant to protect workers when all other methods (elimination, substitution, engineering, and administrative) have been exhausted. All employees must be trained in the proper use and maintenance of PPE.

An S3AM-208-FM1 - PPE Assessment can be performed to help determine PPE requirements. PPE upgrades for individual tasks or steps of a task are to be identified in Pre-AHAs. See Section 4 of the SSHP.

The minimum PPE for site personnel includes:

- Work clothes (long pants and sleeved shirt)
- Work Boots (ANSI approved safety-toed with minimum of 6-inch ankle support, oil resistant sole, and a distinctive heel for employees engaged in activities where a risk of injury to feet may exist)
- Safety glasses with side shields (may be clear or shaded)(ANSI Approved)
- Goggles (when required or desired)
- Hard hat (when overhead hazards exist)
- Work gloves (when required by the activity or when desired)
- Hearing protection (if required)

Procedures for use and selection of PPE are located in S3AM-208 Personal Protective Equipment in **Attachment 2**. The level of protection worn by site personnel will be enforced by the SSHO. To obtain optimum usage from PPE, personnel should inspect all clothing, gloves and boots both prior to and during use for imperfect seams, non-uniform coatings, tears, and poorly functioning closures.

Complete the table below for site-specific PPE:

Additional PPE Needed On Site

(to encompass all task specific additions and upgrades)

Face/ Eyes		Head/ Ears	
<input type="checkbox"/> Spoggles (Safety Glasses with foam liner for dust protection)	<input type="checkbox"/> Chemical Goggles	<input type="checkbox"/> Helmet with Chin Strap	<input checked="" type="checkbox"/> Earplugs
<input type="checkbox"/> Face Shield (splash)	<input type="checkbox"/> Face Shield (impact)	<input type="checkbox"/> Wide Brimmed Hat	<input checked="" type="checkbox"/> Over-ear Hearing Protection
<input checked="" type="checkbox"/> Welding Mask/Goggles			
Hands		Legs/ Feet	
<input checked="" type="checkbox"/> Nitrile	<input type="checkbox"/> Other Chemical Resistant : (specify)	<input type="checkbox"/> High Ankle Boots	<input type="checkbox"/> Metatarsal Guards
<input checked="" type="checkbox"/> Leather		<input type="checkbox"/> Snake Guards	<input type="checkbox"/> Electrically-resistant boots
<input checked="" type="checkbox"/> Cut, Abrasion and Puncture Resistant		<input type="checkbox"/> Rubber Boots/Waders	
<input type="checkbox"/> Impact-resistant			

Body	Equipment
<input checked="" type="checkbox"/> Sunscreen <input type="checkbox"/> Insect Repellent (DEET) <input type="checkbox"/> Permethrin Applied to Clothing <input checked="" type="checkbox"/> Long-sleeved Shirt <input checked="" type="checkbox"/> High-visibility Vest <input checked="" type="checkbox"/> High-visibility Pants <input type="checkbox"/> Disposable Coveralls <input type="checkbox"/> Flame Retardant Clothing <input checked="" type="checkbox"/> Fall Protection <input type="checkbox"/> Personal Floatation Device <input type="checkbox"/> Other: <i>(specify)</i> 	<input checked="" type="checkbox"/> Air/Noise Monitoring Equipment: <i>(specify)</i> <u>Particulate air monitoring</u> <input checked="" type="checkbox"/> Traffic/Work Zone Control Equipment: <i>(specify)</i> <u>Fencing, barricades, cones</u> <input type="checkbox"/> Communication Beyond Cell Phones: <i>(specify)</i> <input type="checkbox"/> Fire Controls: <i>(specify)</i>

10.2 FATIGUE MANAGEMENT PLAN

Fatigue is a mental or physical exhaustion that stops a person from being able to function normally. Work related stress may be related to items such as pace of work schedule, location, environmental conditions (e.g., noise, lighting, tasks), and degree and duration of concentration required to perform a task. Long distance travel causes fatigue primarily by disruption of natural biological rhythms through both external factors and internal factors.

Workers are expected to carry out their work activities in a manner that does not risk the safety and health of themselves, their fellow employees, or any other personnel on the site (e.g., contractors, clients, the public). If an employee feels unable to perform work activities safely due to the effects of fatigue, that employee is required to stop work immediately and notify the supervisor. If this occurs while an employee is driving a vehicle, the employee is required to stop driving and find a suitable location to rest. Similarly, if an employee suspects a co-worker (including subcontractors or clients working with the employee) of suffering from the effects of fatigue, they are required to intervene on behalf of the affected person, stop work and notify the supervisor.

Fatigue management will be conducted by the SSHO. Signs of fatigue include long eye blinks, repeated yawning, frequent blinking, bloodshot eyes, poor reaction time, slow speech, loss of energy, and an inability to concentrate. Fatigue can result in a lack of attention, difficulty following instructions, reduced ability to think clearly, and slower response to changing circumstances. Fatigue contributes to accidents by impairing performance and in extreme cases causing people to fall asleep. Fatigue related “micro sleeps” are very hard to predict or prevent and can place the individual and others safety at risk.

The risk of fatigue can be significantly reduced by effective planning and resourcing of work shifts, work cycles and rotations. Schedules, work cycles or job roles will be assessed by the SSHO for fatigue risks. Controls for mitigating fatigue will be applied, with consideration of the number of employees at risk and the level of risk. Rest is the most important control measure for managing fatigue. Time spent away from the immediate work environment allows workers to recover from fatigue, thereby improving work performance, vigilance, safety and efficiency. To provide adequate rest the SSHO will consider the following:

- Is a 10-hour or longer break between work shifts provided?
- Does the break between work shifts provide a sleep opportunity of 7 or more hours of continuous sleep?
- Is a minimum of one break provided between each 4 hours of work with one break of sufficient length to have a meal (i.e., 30 minutes)?
- Are more frequent short breaks allowed during strenuous activities?
- Is ready access to drinking water provided?

The SSHO will ensure that workers comply with the fatigue management procedures. The SSHO will also assess if workers are fit for duty at the start of work and during the work period. If not fit for duty, the SSHO will notify their supervisor to ensure that appropriate risk mitigation is implemented. The SSHO will review of any fatigue-related incidents and the effectiveness of fatigue mitigation as required. Fatigue related incidents will be reported as incidents or near-misses depending on the overall situations. Fatigue will be considered during incident investigations.

10.3 EMERGENCY PLANS

A communication network will be set up to alert site personnel of emergencies and to summon outside emergency assistance. The ERP and emergency phone numbers will be posted on site and made available to employees (S3AM-010 Emergency Response Planning). These procedures will be reviewed during the on-site safety briefings conducted by the SSHO. Directions from both the Security and Widefield sites to the closest emergency care facility are shown on **Figures 10-1 and 10-3**.

10.3.1 Procedures and Tests

10.3.1.1 Initial Response Procedures

The SSHO will assess the scene for safety and determine what happened, how many victims are on site, and look for others who can assist. If the SSHO determine the site is unsafe, the dangers will be removed, equipment will be shut down, and personnel moved to a safe location. The SSHO may do this or ask another to help. Once the immediate danger is dealt with, the SSHO will complete appropriate emergency and injury safety protocol. Workers will not enter work areas without a buddy and will remain within line of sight of each other.

- Take control of the scene (get everyone's attention and cooperation).
- If necessary call for emergency services (911) and provide first aid/CPR if individual(s) maintain(s) current certification.
- Control secondary incidents if safe to do so (ensure hazards are removed or controlled; issue a stop work order, if required).
- Identify and preserve sources of evidence. In the event of a critical injury, the incident scene must be preserved for potential site visit by a representative from the applicable government agency (if you are unsure, err on the side of caution and leave the site intact).
- Report the incident to the SSHO and PM for implementing stop work orders or immediate corrective action as required.
- Further reporting requirements are discussed in **Section 9** of this APP.

10.3.1.2 Emergency Alarms and Signals

If an emergency occurs, the individual who notices the incident should signal those around and the SSHO. Personnel on site will be alerted to emergencies by verbal command and directed to an assembly point. Alarms will also be used, and may include pressing the horn three times on a vehicle. In the event of an emergency the SSHO will coordinate the appropriate emergency responders. URS will respond until the emergency is under control or until off-site emergency responders have taken control. In the event of an emergency, personnel will use the following hand signals where voice communications are not feasible.

Table 10-1 Hand Signals

Signal	Definition
Hands clutching throat	Out of air/can't breathe
Hands on top of head	Need assistance
Thumbs up	OK/I'm alright/I understand
Thumbs down	No/negative
Arms waving upright	Send back support
Grip partner's wrist	Exit area immediately

10.3.2 Emergency Equipment

A supply of emergency equipment will be maintained in sufficient quantities to ensure an adequate supply for emergency response. Emergency equipment will be fully stocked and

readily accessible as needed. Supplies will be re-ordered as they are used. A monthly inventory will be completed on the first aid kit and infection control kit contents and supplies that have been used and not reported will be re-ordered. Refer to S3AM-012-FM1 - First Aid Kit/AED Inventory and Inspection. The following emergency supplies will be available at the field office and (field location):

- First aid kit, supply list, and infection control kit
- Eyewash – A 15-minute eyewash (required if corrosives are present) or an appropriate amount of portable sterile eyewash bottles will be available on-site for flushing foreign particles or contaminants out of eyes. The SSHO will demonstrate the proper operation of the unit(s) prior to the start of work.
- Emergency phone numbers list.
- Cell phones or portable radios for emergency communications.
- Instant cold packs
- Fire extinguishers
- Soap or waterless hand cleaner and towels

10.3.3 Emergency Evacuation Procedures

In the event of a site emergency requiring evacuation, the SSHO will ensure that the entire field team evacuate as a group to a pre-designated area located a safe distance from any health or safety hazard. During severe weather including lightning, heavy rain, or hail, the building or vehicles will be used as the primary place of refuge. The SSHO (in cooperation with an on-site representative) will designate a primary place of refuge for other emergencies, including tornados, prior to the start of work each day. The daily pre-designated assembly area may have to be re-designated by the SSHO in the event of an emergency where the area of influence affects the primary assembly area.

During any site evacuation, employees will be instructed to observe wind direction indicators. During evacuation, employees will be instructed to travel upwind or crosswind of the area of influence. The SSHO will provide specific evacuation instructions, via the site emergency radio if necessary, to site personnel regarding the actual site conditions.

Once assembled, the SSHO will take a head count. The SSHO will evaluate the assembly area to determine if the area is outside the influence of the situation; if not, the SSHO will redirect the group to a new assembly area where a new head count will be taken.

10.3.4 Contingency Plan - Severe Weather

In the event of severe weather, personnel will shut down field operations and take shelter. The SSHO will provide specific instructions, via the site radios if necessary. Upon notification of an

evacuation, URS, subcontractor, and visitors will immediately proceed to their designated assembly location. In the event of lightning, outdoor work will cease and personnel will move into or stay inside a vehicle or a work site structure.

10.3.5 Drills and Review

Emergency plans will be reviewed at the start of the project and during site visits with the Fire Department or other appropriate entities. Emergency plans will also be reviewed with URS and subcontract workers. Plans will be reviewed and periodically tested with dry runs throughout the project. If any changes are made to the plan, changes will be conveyed to the Fire Department or other appropriate entities, workers and subcontractors, government personnel, and will be posted immediately.

10.3.6 Spill Plan

If hazardous or unknown potentially hazardous materials are unexpectedly spilled during project work activities, evacuate and secure the area (to keep out all personnel). Small spills are immediately reported to the SSHO and are dealt with according to the chemical manufacturer's recommended procedures found on the SDS (**Attachment 5**). Steps will be taken to contain and/or collect small spills for approved containment and disposal.

Spills or releases of hazardous materials that result in human exposure or off-site environmental contamination will be promptly reported by the SSHO to the URS PM. The PM will then contact USACE and proper authorities and the appropriate measures will be taken to contain and/or collect the material for approved storage and disposal.

Work activities may involve the use of hazardous materials (i.e. fuels, solvents) or work involving drums or other containers. When these activities exist the procedures outlined below will be used to prevent or contain spills:

- All hazardous material will be stored in appropriate containers and labelled.
- Tops/lids will be placed back on containers after use.
- Containers of hazardous materials will be stored appropriately away from moving equipment.
- Containers shall only be lifted using equipment specifically manufactured for that purpose.
- Drums/containers will be secured and handled in a manner which minimizes spillage and reduces the risk of musculoskeletal injuries.
- Equipment will be inspected daily for signs of leaks, wear, or strain on parts that, if ruptured or broken, would result in a spill.

URS employees are not expected to take action or to participate in rescues or responses to chemical releases (including of petroleum products) beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and/or public emergency response system (911), unless there is a contractual provision for this response and specially trained employees.

10.3.6.1 Environmental Spill/Release Reporting

All environmental spills or releases of hazardous materials (e.g., fuels, solvents, etc.), whether in excess of the Reportable Quantity or not, will be reported according to the incident reporting procedure. In determining whether a spill or release must be reported to a regulatory agency, the Site Superintendent or qualified worker will assess the quantity of the spill or release and evaluate the reporting criteria against the state-specific reporting requirements, applicable regulatory permit, and/or client-specific reporting procedures. **If reporting to a US state or Federal regulatory agency is required, URS has 15 minutes from the time of the spill/release to officially report it.**

Chemical-specific Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Reportable Quantities for the known chemicals onsite are shown in the table below.

CERCLA Reportable Quantities

Hazardous Substance	Regulatory Synonyms	Final RQ (lb)
1,1,1-Trichloroethane	TCA	1,000
Arsenic	N/A	1
Benzene	N/A	10
Cadmium	N/A	10
Carbon Tetrachloride	N/A	10
Chromium	N/A	5,000
Ethyl Benzene	N/A	1,000
Lead	N/A	10
Mercury	N/A	1
Methyl Ethyl Ketone	MEK	5,000
Nickel	N/A	100
Pentachlorophenol	PCP	10
Selenium	N/A	100
Tetrachloroethylene	Perchloroethylene, PCE	100
Toluene	N/A	1,000
Trichloroethylene	Trichloroethene, TCE	100
Xylene	N/A	100

CERCLA RQ's can be found at: <http://www.epa.gov/oem/docs/er/302table01.pdf>

The spill containment program addresses the following site-specific information:

- Potential hazardous substance spills and available controls;
- Initial notification and response;
- Spill evaluation and response; and
- Post-spill evaluation.

10.3.6.2 Spill Evaluation and Response

The SSHO is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area is isolated and demarcated to the extent possible. When an incidental release occurs, clean-up personnel receive instructions in a pre-clean-up meeting as to spill conditions, PPE, response activities, decontamination, and waste handling.

The procedures of the Emergency Response section of this APP are immediately implemented when the spill is determined to require emergency precautions and action. If necessary to protect those outside the clean-up area, notification of the appropriate authorities is made. **Table 10-2** lists the spill conditions that trigger notification of Federal, state, and local agencies.

The following are general measures that response/clean-up personnel take when responding to a spill:

- To minimize the potential for a hazardous spill, hazardous substances, control/absorbent media, drums and containers, and other contaminated materials are properly stored and labeled;
- When a spill occurs, only those persons involved in overseeing or performing spill containment operations will be allowed within the designated hazard areas. If necessary, the area will be roped or otherwise blocked off. Unauthorized personnel are kept clear of the spill area;
- Appropriate PPE is donned before entering the spill area;
- Appropriate spill control measures are applied during spill response;
- Whenever possible without endangerment of personnel, the spill is stopped at the source or as close to the source as possible;
- Ignition points are removed if fire or explosion hazards exist;
- Surrounding reactive materials are removed;
- Drains or drainage in the spill area are blocked or surrounded by berms to exclude the spilled waste and any materials applied to it;
- Provisions are made to contain and recover a neutralizing solution, if used;
- Small spills or leaks from a drum, tank, or pipe will require evacuation of at least 5 feet in all directions to allow clean-up and to prevent employee exposure. For small spills, sorbent materials such as sand, sawdust, or commercial sorbents (see **Table 10-1** above for site-specific sorbent media) are placed directly on the spill to prevent further spreading and aid in recovery;
- Spill area is sprayed with appropriate foam where the possibility of volatile emissions exists;
- If the spill results in the formation of a toxic vapor cloud, from vaporization, reaction with surrounding materials, or the outbreak of fire, further evacuation may be required;

- To dispose of spill waste, all contaminated sorbents, liquid waste, or other spill clean-up will be placed in small quantities in approved drums for proper storage or disposal as hazardous waste.

10.3.6.3 Post Spill Evaluation

As part of the incident investigation and reporting documentation, a written spill response report shall be prepared at the conclusion of clean-up operations. The report will include, at a minimum, the following information:

- Date of spill incident;
- Cause of incident;
- Spill response actions;
- Any outside agencies involved, including their incident reports; and
- Lessons learned or suggested improvements.

The spill area is inspected to ensure the area has been satisfactorily cleaned. The use of surface and air sampling is utilized in this determination as necessary. The root cause of the spill is examined and corrective steps taken to ensure the engineering and control measures in place have performed as required. If alternative precautions or measures are needed, they are made available and implemented.

All durable equipment placed into use during clean-up activities is decontaminated for future utilization. All spill response equipment and supplies are re-stocked as required.

10.3.7 Fire Fighting Plan

URS employees are not expected to attempt to put out fires. Stop work; notify all URS personnel, move upwind and contact 911 and/or emergency response at the site. If employees have been properly trained in the operation of a fire extinguisher, they may attempt to put out a small fire, provided that the following conditions are met:

- The fire must be small (i.e., smaller than a trash can) and in its early stages.
- The employee must have an escape route.
- The employee must be trained and know they have the right type of extinguisher.
- The employee must be safe from toxic gases.
- There must be no hazardous conditions that could quickly accelerate the fire (i.e., presence of chemicals, especially dry grass, etc.).
- Above all, if in doubt, the employee must not attempt to fight the fire.

Full, 10-lb ABC fire extinguishers will be available on site to contain and extinguish small fires. Fire extinguishers will be available for response and will be positioned to be within 10 seconds

of a potential fire event. Fire prevention procedures are described in S3AM-011 Fire Protection. Site-specific firefighting procedures are found in the SSHP.

- A minimum of two fire extinguishers will be kept on site.
- Vehicles will be equipped with at least one fire extinguisher.

10.3.8 Muster Location

A muster location will be identified during the daily safety briefings and will change based on the area where work is being completed throughout the project.

10.3.9 Communication Procedures

Cell phones will be used for primary communications.

10.3.10 CPR/First Aid Trained Personnel

The SSHO and Site Superintendents are trained in CPR and First Aid.

10.4 VEHICLE INCIDENTS

All vehicles should be rented through Carson Wagonlit Travel (accessible via Ecosystem) to ensure that URS insurance is included in the rental rate. All other insurances should be declined. URS's rental vehicle insurance policy for National/Enterprise or Avis can be found on the DCS Americas United States travel page. **Drivers MUST print and carry the applicable insurance policy for the rental.**

In the event of a vehicle incident (including collisions as well as mechanical difficulties such as breakdowns and flat tires) the following responses are recommended:

- For breakdowns and flat tires, contact an emergency provider.
- For rental vehicles, contact the rental company.
- To the extent possible, URS personnel should not change flat tires or perform similar repairs.
- If a collision has occurred, assess the situation and move all occupants (except the injured) out of further harm's way. If safe to do so, remove the car from the traveled way. Call 911 if necessary, and report the incident to the Incident Hotline at 800-348-5046 as soon as practical. If appropriate, wait for police to arrive before moving vehicles. Provide insurance information to other drivers if necessary or requested and collect the same. If possible, obtain names and phone numbers of witnesses. Take photographs of the scene if possible. **DO NOT ADMIT LIABILITY, AGREE TO PAY FOR DAMAGE, OR SIGN A DOCUMENT RELATED TO AN INCIDENT EXCEPT AS REQUIRED BY LAW.**

10.4.1 Emergency Telephone Numbers

Table 10-2. Emergency Response Team

URS Contacts			
Name	Title	Telephone Number	Mobile Phone
Bill Wemmert	Project Manager	(303) 740-3928	(303) 478-7343
Aric Barto	Project Manager	N/A	(201) 241-4379
David Steele	Project Manager	N/A	(315) 396-8919
Ellis Lumpkins	Site Superintendent	N/A	(407) 810-5741
Joel Vig	Site Superintendent	N/A	(321) 229-9113
Ryan Dailey	Site Safety & Health Officer	(303) 694-2770	Unlisted
Jerry Aldridge	Region SH&E Manager	(979) 230-2184	(979) 230-8039
Robert Sadowski	Area SH&E Manager	(248) 204-4185	(248) 632-2376
Incident Reporting	DCS Incident Reporting & Help Line	800-348-5046	N/A
URS Nurse direct	Use only after incident reporting line	877-878-9525	N/A
Client Contacts			
Name	Title	Telephone Number	Mobile Phone
Doug Simpleman	USACE COR, PM	(402) 995-2753	N/A
TBD	USACE Contracting Officer	TBD	TBD
Organization/Agency			
Police Department El Paso County Sheriff			911 or (719) 390-2373
Fire Department Fountain Fire Department			911 or (719) 322-2080
Ambulance Service (EMT will determine appropriate hospital for treatment)			911
Hospital: CU Health Emergency Room 7890 Fountain Mesa Rd, Fountain, CO 80817			(719) 390-2680
Occupational Clinic: EmergiCare Medical Clinic South 3002 S Academy Blvd, Colorado Springs, CO 80916			(719) 390-7017
Poison Control Center			(800) 222-1222
Pollution Emergency			(800) 424-8802

INFOTRAC (URS's account number 74984)	800-535-5053
URS Hazardous Material Shipping Help Line	800-381-0664
Public Utilities	
Colorado Springs Utilities	(800) 238-5434 (719) 448-4800
Call Before You Dig	811

10.5 MAN OVERBOARD/ABANDON SHIP

This section is not applicable.

10.6 PLAN FOR PREVENTION OF ALCOHOL AND DRUG ABUSE

Illegal use, sale, manufacture, distribution, dispensation, possession (without a physician's prescription) or being under the influence of any controlled substance is absolutely prohibited. Employees are expected and required to report to work on time and in appropriate mental and physical condition for work. URS provides a drug-free, healthful, safe and secure work environment. Refer to Procedure S3AM-019 Substance Abuse Prevention.

10.6.1 Substance Abuse

Drug and alcohol abuse pose a serious threat to the health and safety of employees, clients, and the general public as well as the security of our job sites, equipment and facilities. URS is committed to the elimination of illegal drug use and alcohol abuse in its workplace and regards any misuse of drugs or alcohol by employees to be unacceptable. URS Procedure prohibits the use, possession, presence in the body, manufacture, concealment, transportation, promotion or sale of the following items or substances on company premises. Company premises refer to all property, offices, facilities, land, buildings, structures, fixtures, installations, aircraft, automobiles, vessels, trucks and all other vehicles and equipment - whether owned, leased, or used.

- Illegal drugs (or their metabolites), designer and synthetic drugs, mood or mind altering substances, and drug use related paraphernalia unless authorized for administering currently prescribed medication;
- Controlled substances that are not used in accordance with physician instructions or non-prescribed controlled substances; and
- Alcoholic beverages while at work or while on any customer- or URS-controlled property.

This policy does not prohibit lawful use and possession of current medication prescribed in the employees name or over-the-counter medications. Employees must consult with their health care provider about any prescribed medication's effect on their ability to perform work safely and disclose any restrictions to their supervisor.

Although some states may pass laws legalizing medical or recreational marijuana use, the use, sale, distribution and possession of marijuana are violations of federal law and URS policy, and will subject an employee to disciplinary action up to and including termination in accordance with controlling law.

10.7 SITE SANITATION PLAN

Housekeeping: URS will keep the site as neat as possible, taking into consideration the nature of the work. Regular cleaning or grading will be conducted in order to maintain safe and sanitary conditions. The site will be kept free from clutter and debris. Housekeeping requirements are listed in S3AM-013 Housekeeping in **Attachment 2**.

Drinking Water: Potable water will be provided.

Toilets: Chemical toilets will be provided.

Waste Receptacles: Solid waste receptacles will be provided at field office. Site vehicles will be equipped with contractor trash bags for the collection of solid waste.

10.8 MEDICAL SUPPORT PLAN

The safety of people should always be the first priority. Critical injuries will be immediately referred for professional medical attention. First aid will be administered while awaiting an ambulance or paramedics. Emergency medical treatment, other than first aid, will be administered by the emergency services. If an ambulance is not necessary but medical help is still sought, the directions to the emergency services are shown on **Figures 10-1 and 10-3**.

In the event of any illness or injury, the following steps will be taken:

- Check the victim for consciousness.
- Evaluate the extent of injuries or seriousness of illness. Attend to any injured personnel in so far as is required to prevent further injury and provided no other person is put at risk in the process.
- If emergency services are required, call 911, stabilize the employee and wait for medical staff to arrive.
- Perform First Aid/CPR as necessary, stabilize the injured, decontaminate if necessary.

- Extricate victim(s) only if the environment they are in is dangerous or unsafe or the rescuers cannot safely enter the work zone to transport the victim. Extricate the victim(s) to a safe area for the rescuers. This may require use of medical equipment (back boards, collars, wraps) provided by the rescue personnel. Responders and rescuers will be appropriately protected for potential hazards they may encounter during the rescue.
- Workers with suspected back or neck injuries are not to be moved until professional emergency assistance arrives.

When emergency service personnel arrive, communicate first aid activities that have occurred. Transfer responsibility for care of the injured/ill to the emergency services personnel. The SSHO will accompany the victim to the clinic/hospital.

10.8.1 Non-Critical Injury/Illness

For a non-critical injury/illness, provide first aid treatment and evaluate the need for further treatment by utilizing the services of **WorkCare (877) 878-9525**. Prior to leaving the work site to seek treatment for a non-emergency injury or illness, URS personnel must obtain a signed referral form from the site manager.

10.8.2 Personnel - First Aid/CPR Responders

At least two field members and each SSHO will hold a current certificate in American Red Cross Standard First Aid/CPR or equivalent or the American Heart Association, or from an organization whose training adheres to the standards of the International Liaison Committee on Resuscitation (as stated in writing) or from a Licensed Physician. Classes will contain a hands-on component with a documented CPR and AED practicum. The certificate(s) will state the date of issue and length of validity.

10.9 BLOODBORNE PATHOGEN PLAN

Since first aid responses may expose workers to blood and body fluid, blood-borne pathogen prevention requirements contained in S3AM-111 Bloodborne Pathogens (**Attachment 2**) will be followed. The strategy of "Universal Precautions" was developed by the Centers for Disease Control to address concerns regarding transmission of any bloodborne pathogens, including viruses and worms. Universal precautions are required because all body fluids will be assumed to be infectious. The most common infections discussed are human immunodeficiency virus and hepatitis B virus. Whenever site personnel voluntarily offer first aid that may include potential contact with blood, body fluids, or other potentially infectious materials; universal precautions must be used. PPE and nearby surfaces contaminated with body fluids will also be handled with universal precautions. When workers have workplace contact with another human's body fluids, the Exposure Control Plan discussed in S3AM-111 Bloodborne Pathogens will be implemented. See also **Section 10.16.6**.

10.10 EXPOSURE CONTROL PLAN

When workers have workplace contact with another human's body fluids, the Exposure Control Plan discussed in S3AM-111 Bloodborne Pathogens will be implemented.

10.11 AUTOMATIC EXTERNAL DEFIBRILLATOR (AED) PROGRAM

If an AED will be on site, the AED program shall include, at minimum:

- Training and Retraining: Workers required to use an AED shall be trained per Section 03.A.02.c. All classes shall contain a hands-on component and cannot be taken online. Training shall be on the same model and manufacturer of AED available in the work area. The certificate(s) shall state the date of issue and length of validity;
- Licensed Physician direction and oversight;
- Documented weekly battery and functionality checks;
- Standard Operating Procedures for placement, maintenance, inspections, and EMS activation;
- Equipment Maintenance Program based on the manufacturer's recommendations that, at a minimum, shall include pad replacement (regular and after use) and battery replacement.

10.12 SITE LAYOUT PLAN

The only temporary construction features are a field office and stabilized construction entrance. If required, a layout plan will be submitted for approval to USACE.

10.13 ACCESS AND HAUL ROAD PLAN

It is not foreseen that an access and haul road plan will be needed.

10.14 HEARING CONSERVATION PROGRAM

Heavy equipment (e.g., scrapers, dozers, excavators, drilling equipment) may produce continuous and impact noise at or above the action level of 85 decibels. Personnel within 30 feet of operating equipment, or near an operation that creates noise levels high enough to impair conversation, will wear hearing protective devices (either muffs or plugs). URS personnel who are in the Medical Surveillance Program are automatically enrolled in the URS Hearing Conservation Program and have had baseline and, where appropriate, annual audiograms. Personnel will wash their hands with soap and water prior to inserting earplugs to avoid initiating ear infections due to soiled earplug insertion into the ear canal. Additional information regarding the URS Hearing Conservation Program is located in S3AM-118 Hearing Conservation (**Attachment 2**). In addition, the following forms will be used if noise is quantified:

- S3AM-118-FM2 - Sound Level Survey

- S3AM-118-FM3 - Noise Dosimetry Record

10.15 RESPIRATORY PROTECTION PLAN

The following sections describe the general requirements for respiratory equipment.

10.15.1 Respirator Donning Requirements

When conducting intrusive activities, personnel may be required to don respiratory equipment. Modified Level D PPE will be worn during most incident responses. When air monitor alarm levels for potential chemicals are indicated, personnel in the exclusion zones will don respiratory protection and move upwind of the source. If additional alarms are received, an upgrade in PPE may be required (in accordance with **Section 10.1**).

10.15.2 Medical Clearance and Fit Testing

Only personnel medically cleared to wear respiratory equipment will be assigned to the project.

Workers involved in the investigation activities will be clean-shaven in the area of the face piece seal. Long hair, sideburns, and skullcaps that extend under the seal are not allowed. Glasses with temple pieces extending under the seal are not allowed for full-face air-purifying respirators (APRs). Persons with facial conditions (e.g., missing dentures, scars, severe acne) that prevent a proper seal are not allowed to wear a respirator until the condition is corrected. Contact lenses may not be worn.

No individual will enter an area where the use of respiratory protective equipment (including self-contained breathing apparatus [SCBAs]) is required unless the person has been fit tested within the last year. Fit testing will be performed before field activities occur. Records of fit testing will be maintained in logs.

10.15.3 Respiratory Equipment Use Instructions

Personnel must be properly trained and fitted for the respirator that each individual will use on-site. This training will be in accordance with 29 CFR 1910.134. Site specific training on inspecting and donning APRs, including those slung for escape, will be provided during site safety briefings conducted by the SSHO. Training will be documented.

Respirator wearers will perform a user seal (pressure) check each time the respirator is donned. For APRs, the positive user seal check is performed by first removing the exhalation valve cover, then placing the palm over the respirator exhalation valve and exhaling gently. The respirator mask will puff out without noticeable leakage. The negative user seal check is performed by placing the palms over both of the respirator cartridges, inhaling gently, and holding the breath for 10 seconds. The respirator mask will remain collapsed on the face without noticeable leakage.

All respirator cartridges will be changed out at least daily. The chemical respirator's fit will be rechecked and the cartridges changed if cartridge breakthrough or leakage is suspected. If chemical irritation is present on the skin within the respirator, the worker will leave the area within the exclusion zone and proceed to the personnel decontamination station where doffing of the respirator will occur. As soon as practicable, notify the SSHO who will investigate the area where the chemical irritation was noticed. Investigation will include renewed monitoring upon approach to the area of concern.

10.15.4 Respiratory Equipment Inspection

The user will inspect respirators before and after each use. The inspection procedure for air-purifying respirators (e.g., full-face piece cartridge respirators) is presented below.

- Examine the face piece for:
 - Excessive dirt
 - Cracks, tears, holes, or distortion from improper storage
 - Inflexibility
 - Cracked or badly scratched lenses (full-face only)
 - Incorrectly mounted eyeglass lenses or broken or missing mounting clips (full-face only)
 - Cracked or broken air purifying element holder, badly worn threads, or missing gaskets
- Examine the head straps or head harness for:
 - Breaks or cracks
 - Broken or malfunctioning buckles
 - Excessively worn serration on the head straps, which may permit slippage
- Examine the inhalation valves (2) and exhalation valve for:
 - Foreign material (e.g., hairs, particles, etc.)
 - Improper insertion of the valve body in the face piece
 - Cracks, tears, or chips in the valve body, particularly in the sealing surface
 - Missing or defective exhalation valve covers
- Examine the air-purifying cartridge for:
 - Missing or worn cartridge holder gasket
 - Incorrect cartridge/canister for the hazard
 - Incorrect cartridge installation, loose connections, or cross threading in the holder
 - Cracks or dents in the outside case or threads of filter or cartridge/canister

10.15.5 Cleaning Respirators/SCBAs

Respirators will be assigned to each individual for the duration of field activities. The respiratory equipment must be dismantled and thoroughly cleaned and disinfected after each day's use. Visitors or multi-assigned respirators or SCBAs must be cleaned and disinfected after each use. A disinfectant spray or wipe is approved as a disinfectant between uses during the day but not for cleaning and sanitizing after each day's use. Care must be taken to prevent damage from rough handling during the cleaning procedure. After cleaning, respiratory equipment must be reassembled. The respirator cleaning procedure is presented below.

- **Washing:** Disassemble and wash with a mild liquid detergent in warm water (not to exceed 110 degrees Fahrenheit [°F]). A stiff bristle (not wire) brush may be used.
- **Rinsing:** Rinse in clean water to remove all traces of detergent. This is very important to prevent dermatitis.
- **Disinfecting:** Thoroughly rinse or immerse in a sanitizer provided by the manufacturer.
- **Final Rinsing:** Rinse thoroughly in clean water (110°F maximum) to remove all traces of disinfectant. This is very important to prevent dermatitis.
- **Drying:** Drain and dry hanging by the straps from racks (take care to prevent damage); or towel dry with clean soft cloths or paper towels.

Drying: Drain and dry hanging by the straps from racks (take care to prevent damage); or towel drying with clean soft clothes or paper towels

10.15.6 Maintenance of Respiratory Equipment

Routine respiratory equipment maintenance such as replacing missing valves, gaskets, nose cups etc., must only be performed by trained users or a manufacturer's representative. Only approved replacement parts must be used. Substitution of parts from a different brand or type of respirator invalidates the respirator, which is not permitted. Any respiratory equipment suspected of being defective must be removed from service and replaced.

10.15.7 Storage of Respiratory Equipment

When not in use, respiratory equipment must be stored to protect it from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. Respiratory equipment should be stored in resealable (e.g., Ziploc®) plastic bags between uses. The storage environment must be clean, dry, and away from direct sunlight. Cabinets or cases are suggested. Storing bagged respirators in vehicles is discouraged due to the potential for damage from other material or equipment.

10.16 HEALTH HAZARD CONTROL PROGRAM

Possible health hazards at the work site include biological, chemical and physical hazards. Biological, chemical and physical hazard controls are discussed below and in other plans contained in this section.

10.16.1 Chemical Hazards

Chemical hazards for which there is potential for exposure are described in the SSHP (**Attachment 3**). The only identified chemicals of concern for the project are PFC and PFAS in the groundwater. The potential for exposure is minimal as groundwater will only be in contact during sampling of the treatment system and potentially when connecting piping to the groundwater wells. There is a minimal potential for exposure to naturally occurring metals in soil while excavating and trenching work is completed (mainly via dust inhalation). Monitoring procedures will be in place for air particulates.

10.16.2 Biological Hazards

In addition to the following sections, guidance on identification and avoidance of biological hazards is located in S3AM-313 Wildlife, Plants and Insects, in **Attachment 2**. The SSHO will identify all personnel with known insect or arachnid allergies or sensitivities before fieldwork begins. Personnel with known allergies should carry appropriate medication and should notify the SSHO of this medication's location.

10.16.3 Insects and Arachnids

During fieldwork at Security-Widefield, Colorado, personnel may encounter a wide variety of insects and arachnids including mosquitoes, ticks, spiders, bees, and wasps. Field personnel are encouraged to use insect repellent (SDS must be provided for this repellent). Stings from bees, wasps, and harvester ants and may cause serious allergic reactions in certain individuals.

10.16.3.1 Ticks

Report the tick bite to the SSHO within 4 hours.

10.16.3.2 Mosquitoes

Report the mosquito bite to the SSHO within 4 hours.

Mosquitoes occur anywhere standing water occurs and may transmit the Zika virus and other serious diseases.

Zika is spread mostly by the bite of an infected *Aedes* species mosquito (*Ae. aegypti* and *Ae. albopictus*). These mosquitoes bite during the day and night. Prevent Zika by avoiding mosquito

bites. In 2018, no local mosquito-borne Zika virus transmission has been reported in the continental United States. However, the mosquitoes that can spread Zika are found throughout the United States.

10.16.3.3 Spiders

Report the spiders bite to the SSHO within 4 hours.

Spider bites can be extremely serious (e.g., those of the black widow). Black widow venom affects the nervous system; symptoms can include local reaction, muscle cramps, belly pain, weakness, tremor, nausea and vomiting, faintness, dizziness, chest pain, and trouble breathing. Hobo spiders and brown recluses are more likely, both are brown. The brown recluse spider (the fiddle-back spider), has a violin-shaped marking present atop its abdomen and six eyes arranged in pairs. Hobo spider range from rust to reddish brown, and their patterning does NOT look like a fiddle. Brown recluse spiders have necrotoxic venom that can cause necrotic (dead tissue) lesions. All spider bites can cause aches, itching, and possible infection. The possibility of allergies greatly increases the danger since people are not usually aware of such allergies until bitten. Therefore, spiders should be regarded as a serious potential hazard.

10.16.3.4 Bees

If field personnel have been stung by a bee, the stinger should be removed immediately. Use something to scrape across the affected area (e.g., credit card) to remove the stinger. Once the stinger is removed, wash area with soap and water and apply ice. Monitor affected area for allergic reaction. If field personnel are allergic to bee stings or if an allergic reaction is noticed after a sting, administer doctor prescribed epinephrine (commonly found in an easy to administer epinephrine-pen) shot after sting occurs and seek medical attention immediately. The epinephrine can only be administered to the field personnel in a manner prescribed by a doctor.

10.16.4 Poisonous Snakes

The following are the most dangerous snakes in Colorado. Report the snake bite to the SSHO within 4 hours.

Seven types of highly poisonous snakes may be present in Colorado including the copperhead, cottonmouth (water moccasin), Pygmy rattlesnake (massasauga), timber rattlesnake, prairie rattlesnake, western diamondback rattlesnake, and the midget faded rattlesnake.

10.16.4.1 Copperhead

The copperhead snake is usually 2-3 feet long; and as the name implies – has a copper color with black markings. Although generally nocturnal, copperheads lie in the open during the daytime among dried leaves. Patches of sunlight and shadow causes the scale pattern to blend perfectly

with the background. Because of the rather small size, usually inoffensive disposition, and the low toxicity of its venom; the Copperhead should be placed on the nonfatal list for adults.

10.16.4.2 Cottonmouth (Water Moccasin)

The cottonmouth snake is 3-4 feet long. Young cottonmouths are patterned like a wide-banded copperhead, however the colors are not so reddish. These snakes are always found in the vicinity of water. When approached, the cottonmouth hold their ground and open their mouths widely, revealing the white lining of the mouth, a habit which gives them their common name. This heavy bodied snake is dangerously poisonous and, contrary to popular belief, can bite underwater. The cottonmouth has a vicious disposition. Although nocturnal, the cottonmouth likes to sun-bathe, and basks along shorelines, stretched out on low branches or upon the bank.

10.16.4.3 Pygmy Rattlesnake (Massasauga)

The massasauga snake is usually 24 to 27 inches long. This snake belongs to a group of small rattlesnakes called "ground" or "pygmy" rattlers, which are differentiated from the larger rattlers by having paired scales on top of the head. The massasauga can be found in open fields and rocky outcroppings. Its food consists primarily of small rodents. The small size and usually docile disposition of the massasauga tend to place it upon the nondangerous list; however, its venom is extremely toxic, and any bite from a poisonous snake is dangerous. When aroused, these small snakes strike with a fury not seen in the larger snakes; and the strike may go unannounced, as the rattling is hardly louder than the buzz of a grasshopper.

10.16.4.4 Timber Rattlesnake

The timber rattlesnake is usually 3 to 4 feet long, and occasionally longer. Ground color may vary from a light gray to yellow, with the black chevron-shaped blotches of the back uniting with lateral blotches to form crossbands. The tail is characteristically velvet black in adults; banded in young. The timber rattlesnake prefers the deciduous forest; however, may wander into cultivated fields and open areas during late spring and summer. Its food consists primarily of small rodents and young rabbits. Ordinarily, the timber rattlesnake is a mild-mannered snake, that avoids contact; however, its size and habit (living close to human habitations) necessitate considering the timber rattlesnake dangerous.

10.16.4.5 Prairie Rattlesnake

The Prairie Rattlesnake is 3-4 feet long. The ground color varies from a light gray to green, and the pattern of dorsal blotches with alternating rows of lateral blotches may cause the prairie rattlesnake to be confused with the smaller massasauga. The scales on top of the prairie rattlesnake head are all small, whereas paired plates are present on the massasauga. This rattlesnake frequents rocky open regions, grassy prairies, and agricultural areas. The habit of denning in large groups is well known. Several hundred have been found in hibernation in a

single den. The food of the Prairie Rattlesnake is warm-blooded, mostly rodents and small rabbits. The prairie rattlesnake is active in the daytime.

10.16.4.6 Western Diamondback Rattlesnake

The western diamondback rattlesnake is 4-5 feet long, although some are larger. The color varies somewhat from buff to gray; this snake generally has a faded appearance. The black and white tail bands are distinctive. In the United States, probably more deaths are caused by this snake than by any other. A combination of large size, wide distribution, abundance, and touchy temperament make this snake very dangerous. The western diamondback rattlesnake prefers dry open plains and canyons, where it feeds upon small rodents, young rabbits, and occasionally, birds.

10.16.4.7 Midget Faded Rattlesnake

The midget faded rattlesnake is up to 29.5 inches long. The color pattern consists of a pinkish, pale brown, yellow-brown, straw-colored, reddish or yellow-brown ground color, overlaid with a series of brown elliptical or rectangular dorsal blotches. However, most specimens are gray or silvery. In juveniles the pattern is distinct, but becomes faded in adults, almost to the point where it is indistinguishable from the ground color. The snake lives in westslope of Colorado in rocky outcrops.

10.16.5 Microorganisms and Worms

To prevent fungal and parasitic infections, employees should keep feet clean and dry, and not go barefoot, especially in areas where animals may have defecated. Hookworm, ascaris, and whipworm are known as soil-transmitted helminths (parasitic worms). Hookworm fertilized eggs release immature worms into the soil; these larvae mature into a form that can penetrate the skin of humans. Hookworm infection is mainly acquired by walking barefoot on contaminated soil however, any direct skin contact (including digging) can allow passage of the larvae through the skin. Hookworm (one type), ascaris, and whipworm can be transmitted through ingestion of worm eggs (deposited by infected animals).

10.16.6 Bloodborne Pathogens

Employees are at risk of contracting infectious diseases each time they are exposed to bloodborne pathogens. Any exposure incident may result in infection and subsequent illness. Since infection can occur from a single exposure incident, it is the practice of URS to prevent exposure incidents whenever possible. During site activities, workers can potentially be exposed to bloodborne pathogens when rendering first aid, or CPR; or contact with medical or human waste. As a general rule, employees will not come into contact with any item in the waste debris that may appear to result from human or medical waste disposal. When avoidance is impractical or impossible (e.g., administering first aid), PPE and personal hygiene will be used to prevent adverse effects.

To provide that employees are effectively informed concerning potential workplace health hazards, and in accordance with the requirements set forth in 29 CFR 1910.1030, URS has established an Exposure Control Plan as part of S3NA-111 Bloodborne Pathogens (**Attachment 2**).

The Exposure Control Plan is used to identify those tasks and procedures where occupational exposure to bloodborne pathogens may occur, to identify the positions whose duties include those tasks, and to implement controls that will significantly reduce the risk of infection by bloodborne pathogens. The Exposure Control Plan also includes provisions for affected employees to receive Hepatitis B vaccinations, training, and, if necessary, confidential medical evaluations and follow up.

First aid and CPR responders are trained in bloodborne pathogen universal precautions. In addition, if first aid or CPR is provided; the responders will report their activities in the context of an incident or accident report. The Exposure Control Plan will then be used to determine required steps to protect the responders; and to document those steps have been achieved.

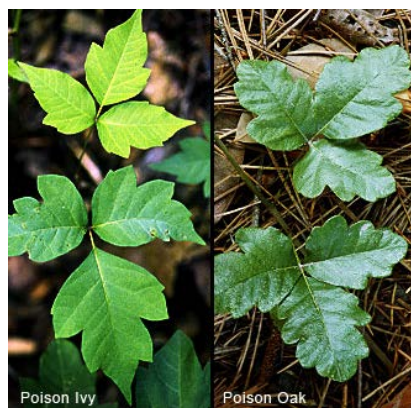
10.16.7 Poison Plants

If you suspect you have been exposed to a poisonous plant while on the job, report the contact to the SSHO within 4 hours.

If exposed to poison ivy, oak, or sumac, wash the exposed areas thoroughly and gently within 10 minutes of contact. Most cases of the rash can be treated with calamine lotion. Clean clothing, tools, or any gear that was exposed to the plants. Note: The plants' toxic oil can remain on clothing and other items for extended periods of time.

10.16.7.1 *Poison Ivy*

Poison ivy is a native woody plant found throughout . Poison ivy has a compound leaf made up of 3 leaflets. The individual leaflets can be 1 to 4 inches long. The leaflets can be many different shades of green and may have a glossy leaf surface or a dull surface. The edges of the leaflets are smooth, toothed, or lobed. The same plant can have several different leaf shapes. Poison ivy contains an oily toxicant in its sap (3-n-pentadecyl-catechol). Contacting the oil causes a skin irritation in sensitive people ranging from a simple itchy inflammation to a severe rash complete with water blisters. The toxic oil is very stable and can remain active for years. This oil can be spread on pet fur, clothing, tool handles, gloves even steering wheels of cars. The best form of protection is wearing long pants and long sleeved shirts to reduce the chance of direct contact with poison ivy. All parts of this plant can cause allergic dermatitis when in contact with skin. A red rash, blisters and itching typically occur within 12 to 24+ hours and can spread if the resinous oil is not correctly and immediately washed off after contact. Contact with contaminated clothing or animal hair can cause symptoms.



10.16.8 Physical Hazards

A variety of physical hazards will be present throughout the course of this project. Field personnel must maintain a high level of situational awareness at all times. The task specific AHA will be completed daily prior to the start of any work actions and updated as site conditions change.

Field personnel will be aware of the fact that when PPE is worn; visibility, hearing, and manual dexterity are impaired.

10.16.9 Slip/Trip/Fall Hazards

As with any field project, uneven work surfaces and other slipping or tripping hazards may be present during field work. Personnel must use caution when walking on unstable or uneven terrain. Proper site housekeeping, removal of trash, and orderly stacking and removal of materials will reduce slipping and tripping hazards. Proper site housekeeping, as described in S3AM-013 Housekeeping (**Attachment 2**), will be the responsibility of all site personnel. The SSHO will make regular entries into a logbook at the end of each shift indicating the work area is adequately clean.

10.16.10 Lifting Hazards

The following guidelines will be followed whenever manually lifting equipment such as portable generators, coolers filled with samples, or any other objects that have an odd size or shape, or that weigh over 40 pounds. Lifting conducted with cranes or hoists are discussed in **Sections 10.37** and **10.38** of the APP.

Safe manual lifting procedures are described in S3AM-014 Manual Lifting, in **Attachment 2**.

- Get help when lifting heavy loads. Portable generators will only be lifted using a two-person lift.

- When moving heavy objects (e.g., drums, containers) – use a dolly or equivalent means of assistance.
- Plan the lift. If lifting a heavy object, plan the route and where to place the object. In addition, plan the communication signals to be used (e.g., “1, 2, 3, lift.”)
- Wear sturdy shoes in good conditions that supply traction when performing lifts.
- Keep your back straight and head aligned during the lift and use your legs to lift the load, do not twist or bend from the waist. Keep the load in front of you, do not lift or carry objects from the side.
- Keep the heavy part of the load close to your body to help maintain balance.

10.16.11 Hand Tools and Portable Equipment

Field personnel may use hand tools and portable equipment in the activities specified in this SSHP. To prevent possible injury to the body, some general guidelines will be applied:

- Use tools only for the task for which the tools were designed. Keep hand and power tools in good repair. Remove damaged or defective tools from service.
- Keep tool surfaces and handles free of excess oil and debris.
- Keep tools clean and return them to a toolbox or other storage area after use. Do not store sharp tools with the sharp edge up.
- Do not carry sharp tools in pockets. Secure tools in holding receptacles prior to carrying tools in areas where dropping of the tools could endanger others on lower surfaces.
- Do not throw tools or drop from heights.
- Inspect all tools prior to use.
- Determine that wrenches have “good bite” prior to applying pressure.
- Use only power tools that will not lock in the “ON” position.
- Use only power fastening devices that are equipped with safety interlock (i.e., the tool must only be capable of initiation/activation when in contact with surface to be fastened).
- Disconnect interlock tools from their power sources to prevent inadvertent starting.
- Do not wear loose clothing or jewelry (including rings) when using power tools.
- Bind long hair that extends beyond chin length prior to working on-site.

Guidelines for specific equipment are included in S3AM-305 Hand and Power Tools, in **Attachment 2**.

10.16.12 Hand Safety

Personnel are to perform work that could expose them to hand injury. All personnel are to wear protective gloves specific to their task at hand. If cold conditions exist, glove liners will be worn underneath all protective gloves. Physical protection gloves (i.e., leather or Kevlar) will be worn as necessary. Hands are to be kept clean to prevent slipping and contamination. Specific guidelines for tool use and hand care are included in S3AM-317 Hand Safety, in **Attachment 2**.

- **All personnel shall have gloves in their immediate possession 100%** of the time when in a shop or on a work site. Gloves that address the hazard shall be worn when employees work with or near any materials or equipment that present the potential for hand injury due to sharp edges, corrosives, flammable and irritating materials, extreme temperatures, splinters, etc. Use the S3AM-317-FM1 - Gloves Needs Assessment to help determine the appropriate glove for the hazard(s).
- **Fixed open-blade knives are prohibited** from use during the course of URS work. Examples of fixed open-blade knives include pocket knives, multi-tools, hunting knives, and standard utility knives. For more information about cutting tools, see S3AM-317-ATT1 - Safe Alternative Tools.

10.16.13 Hand Augering or Shoveling

Muscle strains can occur while hand augering or shoveling. To minimize the occurrence of injury, the following should be observed:

- Keep tools sharp – a dull tool requires more work to advance through the soil.
- Before beginning work, stretch or warm up the body as you would prior to exercising.
- Try to avoid excessive twisting or wrenching motions when using the auger.

10.17 HAZARD COMMUNICATION PROGRAM

The Hazard Communication Program provides personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. The following Procedures related to hazard communication (**Attachment 2**):

- S3AM-115 Hazardous Materials Communication
- S3AM-125 Corrosive and Reactive Materials
- S3AM-117 Hazardous Waste Operations

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this URS-controlled work site must first provide a copy of the item's SDS to the SSHO or PM for review and filing. The SSHO and PM will be responsible for

maintaining and making available, a complete and current SDS inventory at the site, in accordance with S3AM-115 Hazardous Materials Communication.

In accordance with the Hazard Communication Program, the SDSs for the hazardous materials are included in **Attachment 5**. The following chemicals may be brought, used, and stored on site:

- gasoline or diesel fuel
- hydraulic oil

Additional SDSs address potential hazardous chemicals expected to be encountered during intrusive investigations.

10.18 HAZARD COMMUNICATION

Hazardous materials that may be encountered on site as existing environmental or physical/health contaminants are addressed in this APP. Their properties, hazards, and associated required controls will be communicated to all affected staff and subcontractors in accordance with the requirements of URS Procedure S3AM-115 Hazardous Materials Communication including these key elements:

- All personnel shall be briefed on the hazards of any chemical product they use and shall be aware of and have access to the SDS.
- All containers on site shall be properly labeled to indicate their contents. Labeling on any containers not intended for single-day, individual use shall contain additional information indicating potential health and safety hazards (flammability, reactivity, etc.).

10.19 PROCESS SAFETY MANAGEMENT PROGRAM

A Process Safety Management Program of highly hazardous chemicals in accordance with 29 CFR 1910.119 or 29 CFR 1926.64 is not required because there are no covered processes or covered chemicals above the threshold. This section is not applicable.

10.20 LEAD ABATEMENT PLAN

If a Lead Abatement Plan is necessary for a site response, it will be included in the Site-Safety and Health Plan. The Lead Abatement Plan will be written in accordance with EM 385-1-1 (USACE 2014) and S3AM-110 Toxic & Hazardous Substances (**Attachment 2**).

10.21 ASBESTOS ABATEMENT PLAN

This section is not applicable.

10.22 RADIATION SAFETY PROGRAM

This section is not applicable.

10.23 ABRASIVE BLASTING

This section is not applicable.

10.24 HEAT STRESS MONITORING PLAN (HSMP)

Heat stress monitoring will commence when ambient (not adjusted) temperature exceeds 70°F for personnel wearing chemically protective clothing, including semi-permeable protective clothing (i.e., Tyvek or Saranex coveralls) and 90°F for personnel wearing normal permeable work clothes (Level D). The SSHO will maintain Heat Stress Monitoring Records including pulse and body temperature on the S3AM-113-FM1 - Heat Stress Monitoring Log. Work rest schedule will be based on results of body temperature, pulse and self-assessment. Additional information is included in S3AM-113 - Heat Stress.

10.25 COLD STRESS MONITORING PLAN (CSMP)

The timing and location of this project may be such that cold stress could pose a threat to the health and safety of site personnel. Exposure to cold or wet and cold environments can result in cold stress (hypothermia) or cold injury (frostbite).

Symptoms of cold stress exposure are:

- Frostbite - Toes, fingers, cheeks, and ears are most commonly affected. Affected individuals will have an uncomfortable feeling of coldness and numbness, tingling, stinging, or cramping, blanching or whitening of the skin. Skin may have a waxy appearance and be firm to the touch; following exposure. Frozen skin may blister or peel.
- Hypothermia - Hypothermia results when the body loses heat faster than metabolic heat can be produced and the internal temperature drops. Exposure symptoms will follow a general pattern as the body temperature decreases and include: involuntary shivering, speech difficulty, confusion, loss of manual dexterity and coordination, dilated pupils that react to light, and cessation of shivering. When the core body temperature is at 89.6°F, a progressive loss of consciousness; muscular rigidity; decreased respiration; and eventually collapsing, unconsciousness, respiratory and cardiac failure may occur.

Cold stress procedures will be implemented where field crews are working outdoors in damp and cool temperatures (below 50°F for damp and cool conditions or anytime temperatures are below

32°F) conditions or when anytime temperatures are below 32°F or 0 degrees Celsius [°C]). Guidance is provided in S3AM-112 Cold Stress.

10.26 INDOOR AIR QUALITY MANAGEMENT PLAN

The SSHO will report any employee concerns or complaints of indoor air quality (IAQ) problems to the facility manager/owner. That facility manager/owner will be responsible for investigating and resolving the IAQ complaint in a timely manner and reporting back to the SSHO. If the IAQ issue is not resolved in a timely manner a Certified Industrial Hygienist (CIH) or other qualified and competent person will contact the SHM and the PM. The SHM or PM may then initiate an IAQ investigation using appropriate guidelines published by American Conference of Governmental Industrial Hygienist; American Industrial Hygiene Association, American National Standards Institute, American Society of Heating, Refrigeration, and Air Conditioning Engineers; Environmental Protection Agency, OSHA, NIOSH, or other Federal agencies to resolve the issue.

10.27 MOLD REMEDIATION PLAN

This section is not applicable.

10.28 CHROMIUM (VI) EXPOSURE EVALUATION PLAN

This section is not applicable.

10.29 CRYSTALLINE SILICA EVALUATION

The procedure for respirable crystalline silica is described in S3AM-129-PR1. If grout, mortar, clay, or other cementitious materials are used; the APP will contact the SHM who will provide silica monitoring decision logic. If monitoring is required; an addenda to this APP will be prepared and monitoring will proceed (culminating in reporting silica monitoring data to site workers). Engineering and/or administrative controls and PPE will be provided to lessen exposures to crystalline silica. These protocols will be addressed in the APP addenda.

10.30 LIGHTING PLAN FOR NIGHT OPERATIONS

This section is not applicable.

10.31 TRAFFIC CONTROL PLAN

A portion of this work will be completed along and under roadways. Prior to commencing work in the asphalt areas, URS will submit a traffic control plan (S3AM-306 Highway and Road

Work) to the County following Manual on Uniform Traffic Control Devices standards. URS will also set up any inlet protection necessary and coordinate with the County to help keep public disruptions to a minimum. In the paved areas, URS will again start the day with a pre-planning meeting and activity hazard analysis. URS will have a County approved traffic control plan and public notifications in place prior to commencement of the construction work. At the beginning of each day a two-day look ahead will be performed with the PM, on-site Engineer, Site Superintendents, and subcontractor foreman. This meeting will consist of identification of material needs, directions for subcontractors and setting up material deliveries. At this time, a complete safety analysis of the day's work will be reviewed. All necessary trench logs and activity hazard analysis reports will be filled out. If safety concerns arise, outside of the normal trenching and work scope, the safety manager will be present to inspect the conditions and make any necessary adjustments to continue working safely.

10.32 FIRE PREVENTION PLAN

Fire prevention procedures are described in S3AM-011 Fire Protection. For additional information, see S3AM-126 Flammable and Combustible Liquids and S3AM-126-ATT1 Flammable & Combustible Liquid Classifications.

All flammable and combustible materials will be stored outdoors at a location approved and provided by the SSHO, in a well-ventilated area, and away from excessive heat or direct sunlight. These materials will not be stored in areas used for exits, stairways, or aisles. Material that reacts with water will not be stored near flammable or combustible liquids. All sources of ignition will be prohibited in this area, including smoking, cutting and welding, hot surfaces, open flames, sparks (static, electrical, and mechanical), and frictional heat.

Combustible or flammable materials will be stored in proper containers. Gasoline or diesel fuels will be stored approved metal safety cans (with spring loaded lids, spout cover, and flash arresting screen). No plastic gas cans or 5-gallon jerry cans are allowed on the project.

Full, 10 pound (lb) ABC fire extinguishers will be available on site to contain and extinguish small fires. Fire extinguishers will be available for response and will be reachable within 10 seconds of a potential fire event. Fire prevention procedures are described in S3NA-011 Fire Protection. Site-specific firefighting procedures are found in the SSHP.

- A minimum of two fire extinguishers will be kept on site.
- Vehicles will be equipped with at least one fire extinguisher.

Site personnel will be trained to defensively extinguish or control fires in order to provide an evacuation route. The SSHO will direct all firefighting efforts. Flammables and combustible liquids will be stored as detailed in appropriate safety containers.

10.32.1 Hot Work

Before any flame producing devices, (e.g., cutting torches, welding irons) are used a Hot Work Permit must be obtained from local fire department (Fountain or Colorado Springs). Prior to hot work, a detailed inspection of the work area will be conducted to determine if potential fire sources exist. The fire sources will be removed to at least 35 feet away before work can commence.

When welding or cutting takes place, a flash shield is required. No slag or sparks will be allowed to fall onto other workers or visitors. Two 20-lb, 4A:20, portable fire extinguishers will be readily available for hot/flame producing work. A “fire-watch” person will watch out for flying sparks or slag during the welding operation or torch cutting operation. The “fire watch” person will stay at least 30 minutes after welding or cutting has finished for the day to document that no fire is present.

Upon completion of the cutting/welding activities the area will be inspected for hot metal and slag. The fire watch will remain on station for at least 30 minutes after the hot work is completed. Refer to S3AM-332 Hot Work

10.32.2 Heavy Equipment

Each piece of heavy equipment (e.g., bulldozer, excavator, dump truck) and vehicles will be equipped with at least a 10-B: C portable fire extinguisher. During refueling of these machines, engines will be turned off.

10.33 WILD LAND FIRE MANAGEMENT PLAN

This section is not applicable.

10.34 ARC FLASH HAZARD ANALYSIS

An arc flash hazard analysis will be conducted for all electrical equipment supplied at over 50 volts. The analysis will be used to determine the arc flash hazard ranking per National Fire Protection Association (NFPA) 70E and the required engineering and PPE to be used when servicing electrically powered machines and equipment.

10.35 ASSURED EQUIPMENT GROUNDING CONTROL PROGRAM (AEGCP)

An assured grounding program will be instituted to prove that a ground from supply and secondary grounding of frames is effective and continuous. All machine frames supplied by over 150 volt differential, cable trays, electric machines used in water borne environments, statically placed cranes with electric hoists, generators used to provide electrical power to power panels, and electrically powered welding machines will be include in the assured grounding program.

The path to earth will be measured to verify that the earthing ground resistance is sufficiently low to preferentially provide a path to earth; and sized to coordinate with primary overcurrent protection devices (circuit breakers, motor disconnects).

10.36 HAZARDOUS ENERGY CONTROL PROGRAM AND PROCEDURES

During work activities, the potential for exposure to electrical hazards exists. The primary hazards associated with electrical hazards are shock, burns, arc-blast, fire, and explosion. The procedure to reduce worker risk to electrical hazards is presented in S3AM-302 Electrical Safety. S3AM-325 Lockout Tagout must be used when working on any electrical equipment that has the potential to be energized.

To further safeguard workers, the assumption will always be that energetics may be uncovered. For this reason, the generation of static electricity and current flow due to induction field establishment will be minimized.

All motor housings will be guarded, and motors that emit sparks will not be used.

Live panel work is not expected; however, if live panel electrical work becomes necessary, either in the installation of temporary power or the repair of equipment, only a licensed electrician will do this work. Licensure will be attached to this SSHP and will be available on-site during all such electrical work. The electrician will comply with NFPA 70E, which requires a hazard/risk evaluation procedure as part of an electrical safety program. This evaluation includes determination of the shock approach boundaries, flash hazard analysis as required by NFPA 70E; and equipment labeling and tagging for equipment that must remain energized while being serviced. Work areas determined to contain an arc flash hazard will be entered only by the licensed electrician, and these areas will be marked with signage and barricade tape to prohibit all other entry.

Lockout/Tagout procedures as described in S3AM-325 Lockout Tagout will be used when working on any electrical equipment that has the potential to be energized. Further requirements for electrical safety are detailed in S3AM-302 Electrical Safety.

The following forms will be used:

- S3AM-325-FM1 - Lock & Tag Log
- S3AM-325-FM4 - Lockout Tagout Permit

To further safeguard workers, the assumption will always be that energized systems may be uncovered. For this reason, the generation of static electricity and current flow due to induction field establishment will be minimized.

High pressure water washing will not be used if and when dried energetic contamination is visibly determined to be present in the specific area or vessel designated for cleaning. If liquid,

powder, or crystalline solids are retained in unearthed vessels (including small bore pipes), these will be assumed to contain energetics. The term vessels will be used to encompass both piping and open top containers. All liquid not previously characterized as “not containing energetics” will be removed using intrinsically safe pumps. Bonding and grounding of all transfer vessels and receiving waste containers will be required.

All vacuums and pumps used will be grounded. Vacuum transmittal hoses and inlet portals will be non-conductive materials, and the hose will be grounded at mid-length if energetics are suspected in the uptake liquid or solids.

All motor housings will be guarded, and motors that emit sparks will not be used.

During work activities, the potential for exposure to electrical hazards exists. The primary hazards associated with electrical hazards are shock, burns, arc-blast, fire, and explosion. The procedure to reduce worker risk to electrical hazards is presented in S3AM-302 Electrical Safety. S3AM-325 Lockout Tagout must be used when working on any electrical equipment that has the potential to be energized.

To further safeguard workers, the assumption will always be that energetics may be uncovered. For this reason, the generation of static electricity and current flow due to induction field establishment will be minimized.

All motor housings will be guarded, and motors that emit sparks will not be used.

Live panel electrical work will not be performed. Only licensed electricians will perform camp electrical work. Licensure will be attached to the APP and will be available on-site during all electrical work. The electrician will comply with NFPA 70E, which requires a hazard/risk evaluation procedure as part of an electrical safety program. This evaluation includes determination of the shock approach boundaries; flash hazard analysis as required by NFPA 70E; and equipment labeling for equipment that must remain energized while being serviced. Work areas determine to contain an arc flash hazard will be entered only by the licensed electrician, and these areas will be marked with signage and barricade tape to prohibit all other entry

10.36.1 Underground and Aboveground Utilities

URS is responsible for providing all appropriate locations requiring intrusive activities to the subcontractor requesting the utility locate. The SSHO is responsible for making sure all locates have been completed and the sites requiring intrusive activities are cleared for work. Resources include site plans, utility companies, and regional utility locating services. When using compressed air to locate underground utilities, follow the procedures located in S3AM-337 Compressed Air Systems and Testing. The proper utility company personnel will certify in writing to the SSHO the deactivation or location of underground utilities, and the certification retained in the project files.

Procedures for activities next to utility locations are located in S3AM-322 Overhead Lines and S3AM-331 Underground Utilities. Excavation and drilling or similar operations adjacent to overhead lines will not be initiated until operations are coordinated with the utility officials. Operations adjacent to overhead lines are prohibited unless one of the following conditions is satisfied:

Power has been shut off and positive means (e.g., lockout/tagout) have been taken to prevent lines from being energized. Wherever possible, the URS SSHO will observe power shutoff and place a lock and tag on the switch. In all cases utility company personnel will certify in writing to the SSHO the deactivation of overhead utilities, and the certification retained in the project files. The SSHO must also attempt to verify power shut off by checking that power is no longer available to the affected building or equipment.

Equipment, or any part of the equipment, cannot come within the following minimum clearance from energized overhead lines:

Power Lines Nominal System (kilovolts)	Minimum Required Clearance (feet)
0 – 50	10
51 – 200	15
201 – 300	20
301 – 500	25
501 – 750	35
751 – 1000	45

10.37 STANDARD PRE-LIFT PLAN

If a lift becomes required, a Standard Pre-Lift Plan will be included in a site specific CAM and include the following.

An AHA specific to the transporting or hoisting operation will be prepared. The AHA will include:

- Written proof of qualifications of equipment operators, riggers, and others involved in the transporting and hoisting operations.
- Written authorization from the employer stating operator has been trained and authorized to operate the heavy equipment.
- Written proof of qualifications of equipment operators, riggers, and others involved in the transporting and hoisting operations.

- Proper operating procedures in accordance with the equipment manufacturer's operating manual.
- Proper use and on site availability of manufacturer's load rating capacities or charts.
- Proper use of rigging, including positive latching devices to secure the load and rigging.
- Inspection of rigging.
- Use of tag lines to control the load.
- Adequate communications.
- Establishment of a sufficient swing radius (equipment, rigging and load.)

10.38 CRITICAL LIFT PLAN

This section is not applicable because the use of cranes or hoists are not anticipated for this project, however if a critical lift becomes required a Critical Lift Plan will be developed and will be included in a site specific CAM and will include the following

10.38.1 Crane Safety

When cranes and hoist are used, S3AM-310 Cranes & Lifting Devices will be used and the following applicable forms (**Attachment 4**) will be completed:

- S3AM-310-FM1 - Initial and Annual Crane Inspection
- S3AM-310-FM2 - Lift Classification
- S3AM-310-FM3 - Critical Lift Plan
- S3AM-310-FM4 - Daily Crane Inspection
- S3AM-310-FM5 - Monthly Crane Inspection
- S3AM-310-FM6 - Monthly Wire Rope and Hook Inspection

10.38.2 Rigging

When rigging activities occur S3AM-310 Cranes & Lifting Devices will be used. The following forms (**Attachment 4**) will also be used:

- S3AM-310-FM6 - Monthly Wire Rope and Hook Inspection
- S3AM-310-FM9 - Monthly Rigging Inspection

10.39 NAVAL ARCHITECTURAL ANALYSIS - LHE

This section is not applicable.

10.40 FLOATING PLANT INSPECTION AND CERTIFICATION

This section is not applicable.

10.41 SEVERE WEATHER PLAN FOR MARINE ACTIVITIES

This section is not applicable.

10.42 EMERGENCY PLAN FOR MARINE ACTIVITIES

This section is not applicable.

10.43 FLOAT PLAN FOR LAUNCHES, MOTORBOATS, AND SKIFFS

This section is not applicable.

10.44 FALL PROTECTION AND PREVENTION PROGRAM

Although it is not anticipated that working heights will exceed 4 feet, the following Fall Protection and Prevention Plan will be followed if necessary.

For fall protection and prevention, S3AM-304 Fall Protection will be used. The following forms will also be used:

- S3AM-304-FM1 - Fall Protection Harness Inspection
- S3AM-304-FM2 - Fall Protection Lanyard Inspection
- S3AM-304-FM3 - Fall Protection Life Line Inspection
- S3AM-304-FM4 - Fall Protection Rope Grap Inspection
- S3AM-304-FM5 - Fall Protection Cable Sling Inspection
- S3AM-304-FM6 - Fall Protection Carabiner Inspection
- S3AM-304-FM7 - Fall Protection Plan
- S3AM-304-FM8 - Alternative Fall Protection Permit

Primary fall protection systems (e.g., standard guardrails, solid floor with complete standard guardrails, patented or wooden scaffolding [including bracket type], area lifts [scissor lift], approved personnel hoist) will be used whenever possible to provide fall protection. These systems will be complete walking/working systems with standard guardrails, free of floor holes, and have a safe means of access/egress. When fall hazards cannot be eliminated through any

other means, fall arrest systems will be used to control falls. Proper training on the use of fall arrest equipment is essential and will be provided prior to use.

10.44.1 Scaffolding

This section is not applicable.

10.44.2 Guard Rail Systems

Top-rails and posts, and will have a vertical height of 42 +/- 3 inches (106.6 +/- 7.6 centimeters [cm]) from the upper surface of the top-rail to the floor, platform, runway, or ramp level. Mid-rails will be erected halfway between the top-rails and the floor, platform, runway, or ramp.

The ends of the top-rails and mid-rails will not overhang the terminal posts except where such overhang does not create a projection hazard. Toe boards will be provided on all open sides/ends at locations where persons are required or permitted to pass or work under the elevated platform or where needed to prevent persons and material from falling from the elevated platform.

Strength requirements - top-rails and mid-rails will be designed to meet the following requirements:

- Top-rail will be capable of withstanding, without failure, a force of at least 200 lb (0.9 kilonewtons) applied within 2 inches (5 cm) of the top edge, in any outward or downward direction, at any point along the top edge. When the force described above is applied in a downward direction, the top edge of the top rail will not deflect more than 3 inches (7.6 cm) nor to a height less than 39 inches (99 cm) above the walking/working level.
- Mid-rails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members will be capable of withstanding, without failure, a force of at least 150 lb (666 newtons) applied in any downward or outward direction at any point along the mid-rail or other member. Guardrail systems will be so surfaced as to prevent injury to a worker from punctures or lacerations and to prevent snagging of clothing.
- Wire rope, 3/8-inch minimum, may be used as a top rail and mid-rail. All wire rope used as guardrail must be flagged every 6 feet with high visibility tape or flagging.
- Steel banding and plastic banding or common rebar will NOT be used as top rails or mid-rails.

See Appendix B of OSHA 29 CFR 1926 Subpart M for guidance for consideration of wood, pipe, and steel railing systems.

10.44.3 Personal Fall Arrest Systems - Stopping a Fall

Personal fall arrest systems, when stopping a fall, will:

- Limit maximum arresting force on an employee is 1,800 lb (816.4 kilogram [kg]) when used with a full-body harness;
- Be rigged such that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level or other physical hazard;
- Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.1 meters); and
- Have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 meters) or free fall distance permitted by the system, whichever is less.

10.44.4 Anchorage and Attachment

- Anchorage used for attachment of personal fall arrest equipment will be independent of any anchorage used to support or suspend platforms and will be capable of supporting at least 5,000 lb (2,267.9 kg) per employee attached.
- The attachment point for body belts in a positioning device system will be located on the sides or on the front; the attachment point for body harnesses will be located in the center of the wearer's back near shoulder level, or above the wearer's head.
- Personal fall arrest systems will not be attached to guardrail systems nor will they be attached to hoists.
- When a personal fall arrest system is used at hoist areas, it will be rigged to allow the movement of the employee only as far as the edge of the walking/working surface.

10.44.5 Positioning Devices

Positioning device systems will:

- Be rigged such that an employee cannot free fall more than 2 feet (0.6 meter); and
- Be secured to an anchorage capable of supporting at least twice the potential impact load of an employee's fall of 3,000 lb (1,360.7 kg), whichever is greater.
- Whenever using body belt, the maximum arresting force on an employee will not exceed 900 lb (409 kg).

When necessary, body belts and harnesses will have two lanyards to document that a person is tied-off with at least one lanyard at all times, or where the lanyard is the primary support for operations (e.g., rock-scaling and high-wall concrete finishing.)

The manufacturer's recommendations will be followed in the fitting, adjustment, use, inspection, testing, replacement, and care of personal fall protection equipment. Before an employee uses personal fall protection equipment, he/she will receive instruction in these recommendations and the potential fall hazards of the activity.

Personal fall protection equipment will be used only for employee safeguarding. Any such

equipment subjected to impact loading will be immediately removed from service, and will not be used again for employee safeguarding.

10.44.6 Lifelines

- When vertical lifelines are used, each employee will be attached to a separate lifeline.
- On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline will be capable of locking in both directions on the lifeline.
- Horizontal lifelines will be designed, installed, and used under the supervision of a qualified person as part of a complete fall arrest system that maintains a safety factor of at least two. Rope grab will not be used or connected to the horizontal life line.
- Lifelines used on rock-scaling operations or in areas where the line may be subject to cutting or abrasion will be specifically designed and constructed for such applications.

10.44.7 Retractable Lifelines

A retractable lifeline is a fall arrest device used in conjunction with other components of a fall arrest system. Retractable lifelines will be used by one person at a time.

A properly inspected and maintained retractable lifeline, when correctly installed and used as part of the fall arrest system, automatically stops a person's descent in a short distance after the onset of an accidental fall.

Retractable lifelines may be considered when working in areas (e.g., on roofs and scaffolds, or in tanks, towers, vessels, and manholes). Also, retractable lifelines will be considered when climbing such equipment as vertical fixed ladders. Before using a retractable lifeline, the supervisor and/or the user must address the following questions:

- Has the user been trained to use a retractable lifeline correctly?
- Is the retractable lifeline being used in conjunction with a complete fall arrest system?
- Is the equipment under a regular maintenance program?
- Has the equipment been inspected within the last six months?

10.44.8 Standard Harnesses

Harnesses for general-purpose work will be Class III, constructed with a sliding back D- ring. Standard harnesses are suitable for continuous fall protection while climbing, riding, or working on elevated personnel platforms. They are suitable for positioning, fall arrest, and the rescue and evacuation of people who are working at elevated heights.

10.44.9 Full-Body Harness Systems

A full body harness system consists of a full-body harness, lanyard, energy shock absorber, and self-locking snap hook. Before using a full-body harness system, the SSHO and/or the user must

document the answers to these questions:

- Has the user been trained to recognize fall hazards and to use fall arrest systems properly?
- Are all components of the system compatible according to the manufacturer's instructions?
- Have appropriate anchorage points and attachment techniques been engineered and reviewed?
- Has free-fall distance been considered so that a worker will not strike a lower surface or object before the fall is arrested?
- Have swing-fall hazards been eliminated?
- Have safe methods to retrieve fallen workers been planned?
- Has the full-body harness and all of its components been inspected both before each use and on a regular semi-annual basis or per manufacturer's instructions?
- Is any of the equipment, including lanyards, connectors, and lifelines, subject to such problems as welding damage, chemical corrosion, or sandblasting operations?

10.44.10 Inspection and Maintenance

Personal fall protection equipment will be inspected by the worker prior to each use to determine that is in a safe working condition. A competent person will inspect the equipment at least once semi-annually and whenever subjected to severe use: defective equipment will be immediately replaced.

To document that fall protection systems are ready and able to perform their required tasks, a program of inspection and maintenance will be implemented and maintained. The following as a minimum, will comprise the basic requirements of the inspection and maintenance program:

- Equipment manufacturer's instructions will be incorporated into the inspection and preventive maintenance procedures.
- All fall protection equipment will be inspected prior to each use, and a documented inspection at intervals not to exceed 6 months, or in accordance with the manufacturers guidelines.
- The user will inspect his/her equipment prior to each use and check the inspection date.
- Any fall protection equipment subjected to a fall or impact load will be removed from service immediately and inspected by a qualified person (sent back to the manufacturer).
- Check all equipment for mold, damage, wear, mildew, or distortion.
- Hardware will be free of cracks, sharp edges, or burns.
- Document that no straps are cut, broken, torn or scraped.
- Special situations (e.g., radiation, electrical conductivity, and chemical effects) will be considered.

- Equipment that is damaged or in need of maintenance will be tagged as unusable, and will not be stored in the same area as serviceable equipment.
- A detailed inspection policy will be used for equipment stored for periods exceeding one month.
- Anchors and mountings will be inspected before each use by the user and supervisor for signs of damage.

10.44.11 Fall Arrest Rescue Plan

In the event that a fall-arrest occurs, follow fall rescue training procedures:

- First Person Aware of Accident - Call 911 and inform them of your location.
- Notify All Team Members – Site QC
- SSHO respond to site of accident.
- PM (SSHO or other site team member) to report to main gate to signal rescue vehicles and direct to site of accident.
- Superintendent/Foreman – bring man lift equipment and ladder to site of accident.

10.44.12 Rescue Operations

In the event of a Fall-Arrest Rescue, the appropriate approved subcontractor Fall Arrest Rescue Plan and AHA will be implemented in conjunction with the ERP.

- A site specific Fall Protection and Rescue Plan for any work 6 feet or greater will be submitted. The plan will be submitted in conjunction with the AHA to USACE for acceptance 10 working days prior to the scheduled QC prep/safety orientation meeting.

10.45 DEMOLITION/RENOVATION PLAN

This section is not applicable.

10.46 ROPE ACCESS PROGRAM

This section is not applicable.

10.47 EXCAVATION/TRENCHING PLAN

URS and subcontractors' employees may be exposed to hazards associated with excavation activities during the course of field activities. Hazards associated with excavation areas include, but are not limited to, stability of adjacent structures, slip/trip/fall hazards, and hazardous

atmospheres. In the field, approaches that do not require personnel to enter excavations are preferred. Refer to S3AM-303 Excavation (**Attachment 2**).

In the event that excavation or trenching activities that require personnel to enter the excavation or present a potential for collapse (greater than 4 feet), the appropriate approved subcontractor Excavation Plan and AHA will be implemented in conjunction with the ERP.

10.47.1 Underground and Aboveground Utilities

Each site with planned intrusive activities will be inspected for underground and aboveground utilities. Utilities will be handled in accordance with S3AM-322 Overhead Lines and S3AM-331 Underground Utilities (**Attachment 2**).

10.48 FIRE PREVENTION AND PROTECTION PLAN FOR UNDERGROUND CONSTRUCTION

This section is not applicable.

10.49 COMPRESSED AIR PLAN

This section is not applicable.

10.50 ERECTION AND REMOVAL PLAN FOR FORMWORK AND SHORING

This section is not applicable.

10.51 PRECAST CONCRETE PLAN

This section is not applicable.

10.52 LIFT SLAB PLAN

This section is not applicable.

10.53 MASONRY BRACING PLAN

This section is not applicable.

10.54 STEEL ERECTION PLAN

This section is not applicable.

10.55 EXPLOSIVES SAFETY SITE PLAN

This section is not applicable.

10.56 BLASTING PLAN

This section is not applicable.

10.57 DIVE OPERATIONS PLAN

This section is not applicable.

10.58 SAFE PRACTICES MANUAL FOR DIVING ACTIVITIES

This section is not applicable.

10.59 EMERGENCY MANAGEMENT PLAN FOR DIVING ACTIVITIES

This section is not applicable.

10.60 TREE FELLING/MAINTENANCE PROGRAM

This section is not applicable.

10.61 AIRCRAFT/AIRFIELD CONSTRUCTION SAFETY & PHASING PLAN

This section is not applicable.

10.62 AIRCRAFT/AIRFIELD SAFETY PLAN COMPLIANCE DOCUMENT

This section is not applicable.

10.63 SITE SAFETY AND HEALTH PLAN

The Site Safety and Health Plan is included as **Attachment 3** to this APP.

10.64 CONFINED SPACE ENTRY PROCEDURES

Confined space entry is not anticipated, however if confined space entry is required during field activities, a Confined Space Entry Plan will be prepared. The Confined Space Entry Plan will be

written in accordance with EM 385-1-1 (USACE 2014) and S3AM-301 Confined Spaces (**Attachment 2**).

10.65 CONFINED SPACE PROGRAM

The URS confined space program S3AM-301 Confined Spaces is included in **Attachment 2**.

10.66 MACHINERY AND MECHANIZED EQUIPMENT

Every person operating a motor vehicle will provide a license/permit valid for the equipment being operated. Licensing requirements will be as per state regulations for civilian personnel, to include contractors. Inspections, tests, maintenance, and repairs will be conducted by a qualified person in accordance with the manufacturer's recommendations. Operation of heavy equipment (e.g., excavator) during site activities presents potential physical hazards to personnel. Issues associated with heavy equipment operations are addressed in detail in S3AM-309 Heavy Equipment included in **Attachment 2**.

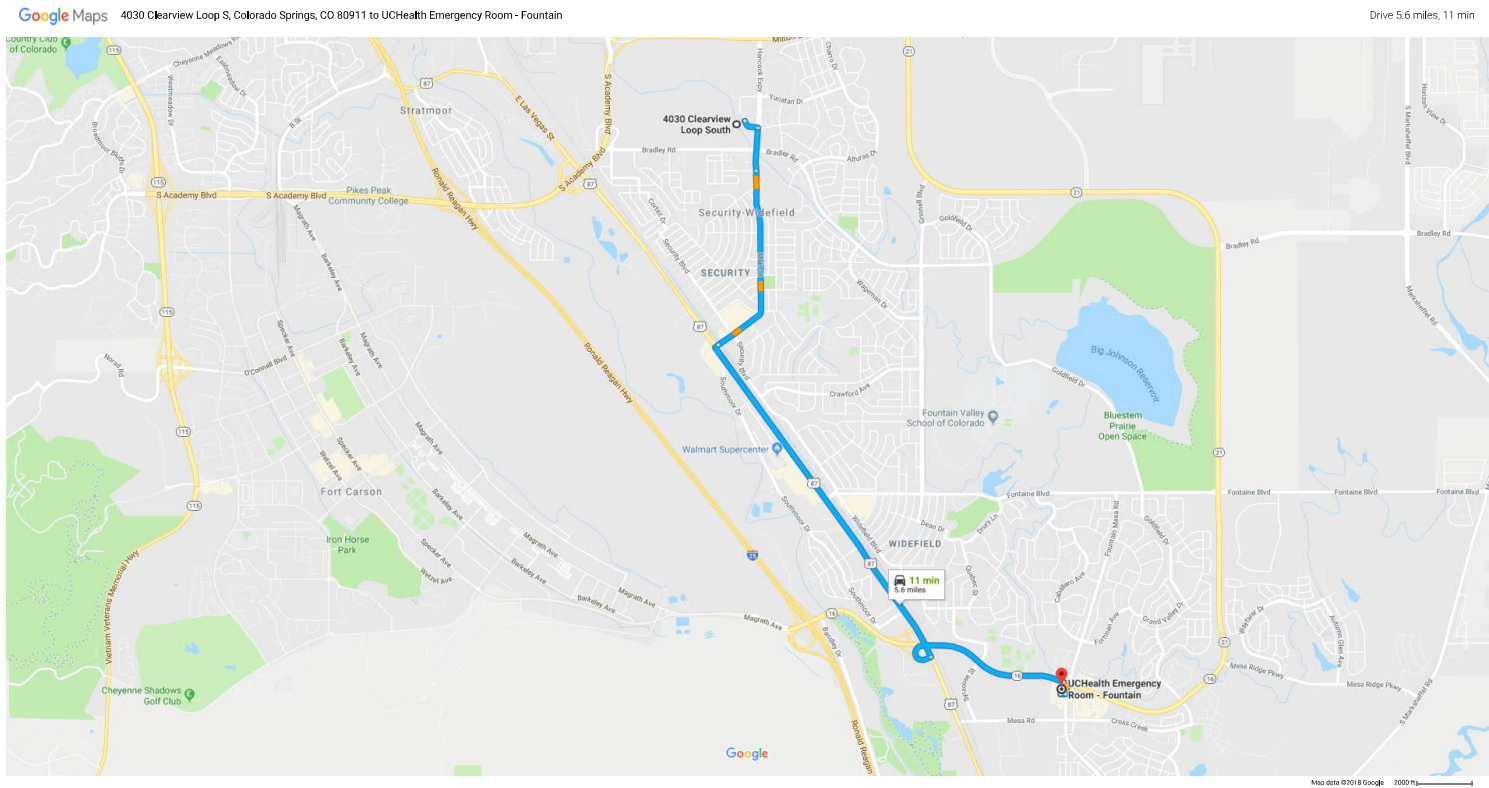
10.67 DRIVING AND VEHICLE SAFETY

The proper operation of vehicles is critical to protecting the safety of URS employees and subcontractors. Drivers face numerous hazards while operating vehicles. Some of the hazards include collision with another vehicle, collision with a fixed object, vehicle break down or failure, or falling asleep or becoming otherwise incapacitated while driving. All employees will adhere to procedure S3AM-005 Driving, which includes the following key practices:

- **Authorized Drivers** - Managers must authorize drivers following evaluation of driver criteria to drive and maintain an URS-owned, leased or rented vehicle, a client or customer-owned vehicle, or a personal vehicle operated in the course of conducting URS business.
- **Electronic Devices Prohibited** - URS prohibits use of all portable electronic devices while operating a motor vehicle/ equipment which includes being stopped at a traffic light or stop sign. This includes cell phones, two-way radios and other items whether hand-held or hands-free. Electronic devices include, but are not limited to, all mobile phones, pagers, iPods, MP3s, GPS, DVD players, tablets laptops and other portable electronic devices that can cause driver distraction. Hands-free device use is not allowed.
 - GPS units and devices used for navigation may only be used if factory installed or secured to the vehicle with a bracket that allows the driver to view the image without having to take their eyes off the road. Electronic devices shall be setup for operation prior to commencing driving activities and shall not be changed by the driver while driving.

- **Vehicle Inspections** - The driver shall conduct pre-trip vehicle inspections prior to each trip. An S3AM-005-FM2 - Vehicle Inspection Checklist, can be used to guide and document the inspection process. Vehicle inspection is to include a 360-degree walk around and visual inspection under the vehicle for leaks and obstructions prior to moving the vehicle.
- **Training** - All drivers shall complete defensive driver training. Additional training (i.e., hands-on defensive driver training) may apply for medium and high-risk drivers; see procedure S3AM-005 Driving and procedure S3AM-003 SH&E Training for more details.
- **Journey Management Plan** - Drivers who undertake trips in excess of 250 miles (400 kilometers) one way, drive in remote or hazardous areas, or when otherwise deemed necessary, shall develop and document a S3AM-005-FM1 - Journey Management Plan or equivalent.
- **Secure Loads** - Cargo is only to be carried within the passenger compartment of a vehicle when segregated and restrained to prevent objects from becoming distractions, obstructions or projectiles to occupants should emergency vehicle maneuvers be required (e.g., harsh braking or crash). All goods transported on flatbed trucks or in pickup beds must be securely fastened to prevent them from becoming hazards. All applicable laws and regulations regarding securing of loads must be met. It is prudent to check the load after a few miles to ensure that load has not shifted or loosened prior to completing the remainder of the trip.
- **Backing Up** - Reversing the vehicle is to be avoided if at all possible. If backing up is necessary, use the following guidelines:
 - Pre-plan all vehicle movements.
 - If the pull-through method of parking is not possible, drivers will scan parking spot/area for hazards and back in; thereby, facilitating departure where the first move is forward.
 - A light tap of the horn should be used to alert others of your intention to back up.
 - Avoid tight spaces.
 - Vehicles over 10,000 lb gross vehicular weight are required to have a competent spotter in place when backing. A competent spotter is one that has received spotter training.
 - All vehicles shall have a competent spotter in place when backing in an active work zone. Parking and public access areas are recommended but not required to have a spotter.

Figure 10-1 Route from Security to Hospital



- 4030 Clearview Loop S

Colorado Springs, CO 80911
- Take Main St to US-85 S/US-87 S

5 min (1.7 mi)

↑

1. Headsoutheast on Clearview Loop S toward Clearview Frontage Rd

0.1 mi

➡

2. Turnright onto Hancock Expy

0.3 mi

↑

3. AtI7-Eleven, continue onto Main St

1.3 mi

Continue on US-85 S/US-87 S to Fountain

6 min (3.7 mi)

↙

4. Turnleft onto US-85 S/US-87 S

Pass by Jack in the Box (on the right in 1.0 mi)

2.5 mi

↗

5. Turn right to merge onto CO-16 E

1.2 mi

Continue on Fountain Mesa Rd to your destination

1 min (0.2 mi)

➡

6. Turnright onto Fountain Mesa Rd

472 ft

➡

7. Turnright

184 ft

➡

8. Turnright

69 ft

➡

9. Turnright

Destination will be on the left

223 ft

UCHealth Emergency Room - Fountain

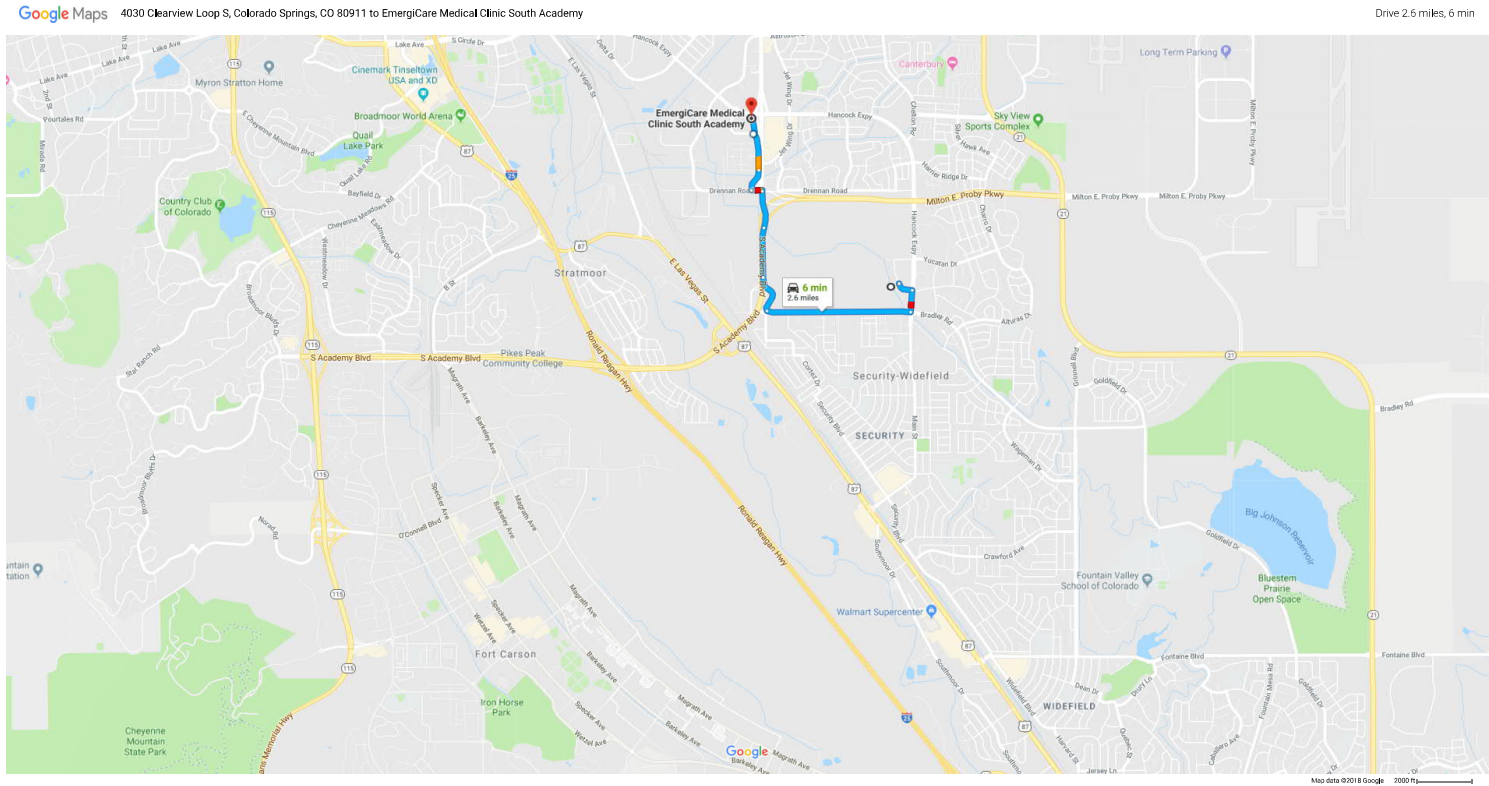
7890 Fountain Mesa Rd, Fountain, CO 80817

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

https://www.google.com/maps/dir/38.7725199,-104.7417234/UCHealth+Emergency+Room+--+Fountain,+Fountain+Mesa+Road,+Fountain,+CO/@38....

1/1

Figure 10-2 Route from Security to Clinic



- 4030 Clearview Loop S

Colorado Springs, CO 80911
- ↑

1. Head southeast on Clearview Loop S toward Clearview Frontage Rd

32 s (6.1 mi)
- Drive from Bradley Rc and S Academy Blvd to Colorado Springs

5 mi (2.4 mi)
- 2. Turnright onto Hancock Expy

0.1 mi
- 3. Turnright at the 1st cross street onto Bradley Rd

0.9 mi
- 📍

4. At the traffic circle, take the 1st exit onto the Academy Boulevard ramp to Northbound

0.3 mi
- 5. Merge onto S Academy Blvd

0.3 mi
- 6. Use the left lane to continue toward Drennan Road

0.2 mi
- 7. Turnleft at the 1st cross street onto Drennan Road

400 ft
- 8. Turnright toward Boychuck Ave

0.1 mi
- ↑

9. Continue onto Boychuck Ave

0.2 mi
- 10. Turn right

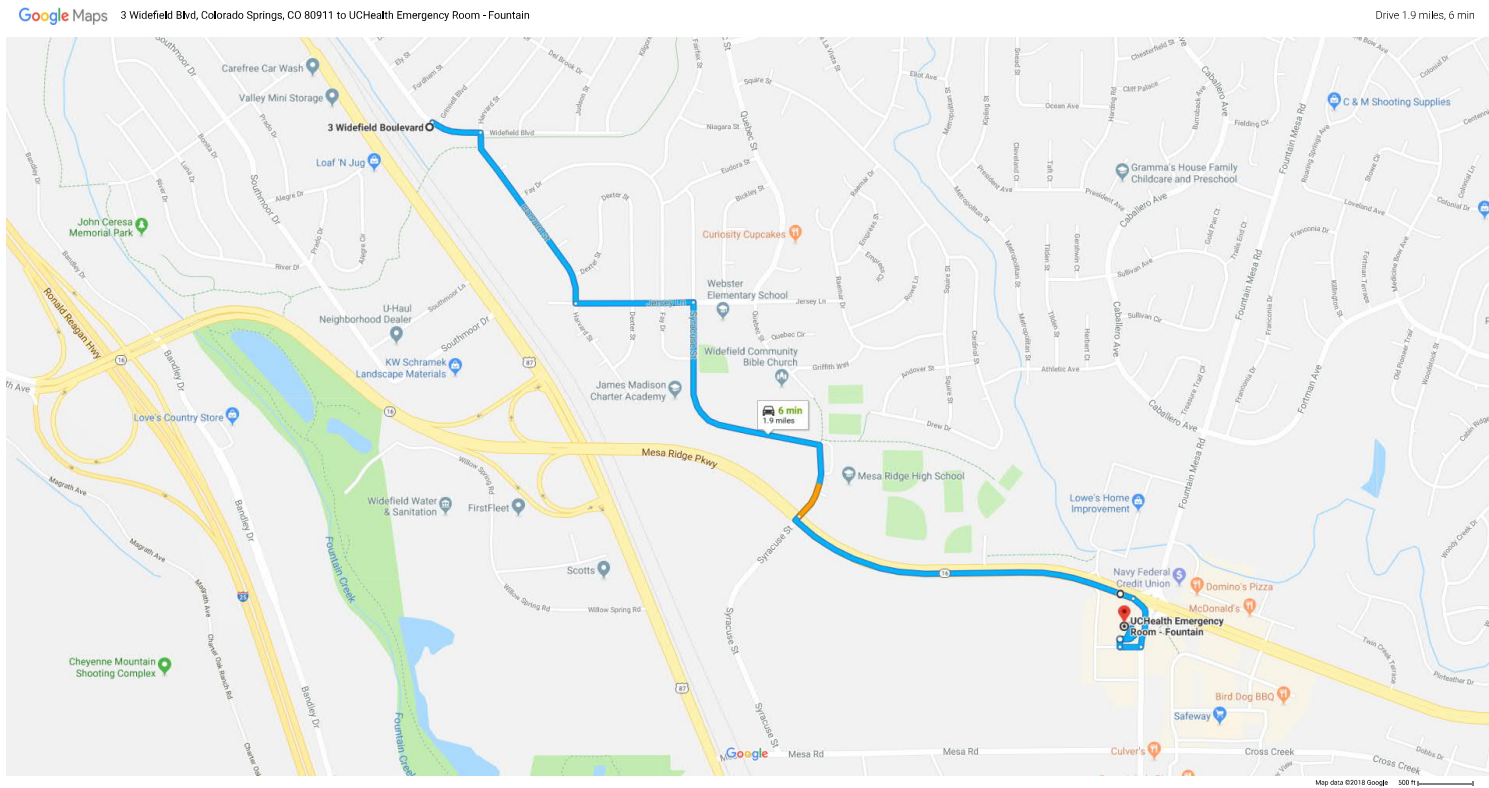
Destination will be on the left

32 s (6.1 mi)

EmergiCare Medical Clinic South Academy
3002 S Academy Blvd, Colorado Springs, CO 80916

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Figure 10-3 Route from Widefield to Hospital

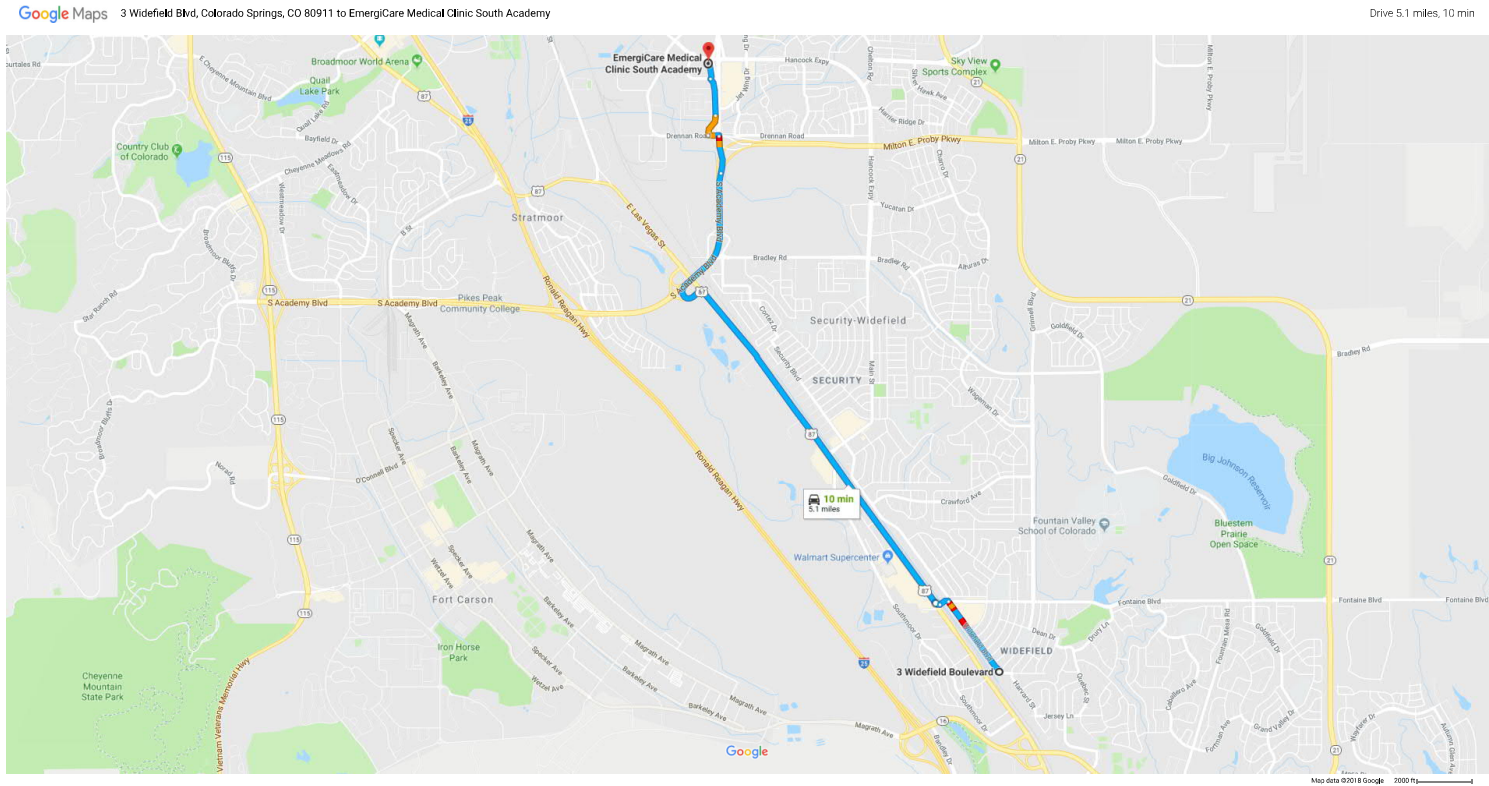


- 3 Widefield Blvd**
Colorado Springs, CO 80911
- Drive from Harvard St, Syracuse St and CO-16 E to Fountain
5 min (1.8 mi)
1. Headsoutheast on Widefield Blvd toward Grinnell Blvd
440 ft
 2. Turnright onto Harvard St
0.3 mi
 3. Turnleft onto Jersey Ln
0.2 mi
 4. Turnright at the 3rd cross street onto Syracuse St
0.5 mi
 5. Turnleft onto CO-16 E
0.6 mi
 6. Turnright onto Fountain Mesa Rd
472 ft
- Drive to your destination
54 s (476 ft)
7. Turnright
184 ft
 8. Turnright
69 ft
 9. Turnright
Destination will be on the left
223 ft

UCHealth Emergency Room - Fountain
7890 Fountain Mesa Rd, Fountain, CO 80817

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Figure 10-4 Route from Widefield to Clinic



11.1 RISK MANAGEMENT PROCESS (AHAs)

All executed work scope tasks will have an AHA. The intent of the AHA is for task clarification and hazard awareness, as an incident investigation tool, and for informing employees of specific task hazards and protective measures. AHAs must be performed and documented before the given task begins. The team (or person) responsible for the AHA will be competent in a formal process of hazard recognition. The information from the AHA will be communicated to all staff on-site. If the person responsible for implementing control measures is not available to implement those measures, work must stop and the AHA must be revised.

Site-specific AHAs are presented in **Attachment 1**. Detailed project-specific hazards and controls will be provided by AHAs for each activity.

1. The AHA defines the work sequence, anticipated hazards, conditions, equipment, materials, personnel and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk, and the RAC for each step.
2. Acceptance of risk. The residual risk is that which remains after controls have been applied. This residual risk must be communicated to the proper authority for acceptance in order to proceed with the activity.
3. Before beginning each work activity, URS will prepare the initial AHA, which will include a RAC for that activity. That AHA will define the activities being performed, identify the work sequences, specific hazards anticipated, site conditions, equipment, materials, and the control measures that will be implemented to eliminate or reduce each hazard to an acceptable level of risk. Detailed site specific hazards and control templates will be provided by an AHA for each major task.
4. No work will begin on an activity until the initial AHA has been accepted by the GDA addressing the project-specific hazards. Work will not begin until the AHA for the work activity have been accepted by the URS SHM; and reviewed on site by all workers engaged in the activity.
5. AHAs will be created by URS and any subcontractor field crews/workers performing the work. AHAs are living documents and are intended to be created in the field and updated (by the workers) as needed.
6. The AHA will be reviewed and modified as necessary to address changing site conditions, operations, or change of competent persons.
 - (a) If a new competent person (not on the original list) is added, the list will be updated (an administrative action not requiring an updated AHA). The new person will acknowledge in writing that he or she has reviewed the AHA and is familiar with current site safety issues.
 - (b) If the initial RAC increases due to a change made to the AHA by the workers, the AHA will be resubmitted to USACE for acceptance prior to work proceeding.

- (c) Changes to or updates of an AHA that do not increase the RAC are not required to be resubmitted for acceptance by the USACE.
- 7. Workers/crews will have in their possession the current AHA that reflects current site conditions, personnel, equipment, and control measures, while the work is being performed.
- 8. The AHA will be used by URS and USACE to assure work is being performed in accordance with the AHA. In the event that the work is not being conducted in a safe manner, URS and/or USACE will stop the unsafe work being conducted until work is in compliance with EM 385-1-1 and this APP.
- 9. Once the activity has been completed, the AHA will be available and kept on file on site for the length of the contract.

11.2 MANAGEMENT OF CHANGE

The AHA will be regularly reviewed and modified as necessary to address changing site conditions, operations, or change of the competent person. Any proposed changes will be reviewed and approved by the SSHO and SHM, or designated representative, prior to their implementation following the guidance in S3AM-215 Management of Change (**Attachment 2**). The SSHO as delegated by the SHM will record changes on S3AM-215-FM1 - Management of Change Authorization Form. No modifications to this plan will conflict with governmental regulations.

This Accident Prevention Plan (APP) conforms to the regulatory requirements and guidelines established in the following documents:

- Title 29, Part 1910 of the Code of Federal Regulations (29 CFR 1910), Occupational Safety and Health Standards (with special attention to Section 120, Hazardous Waste Operations and Emergency Response).
- Title 8 of the California Code of Regulations (8 CCR), with special attention to Section 5192 Hazardous Waste Operations and Emergency Response, and Section 3202, Injury Illness Prevention Program.
- 29 CFR 1926, Safety and Health Regulations for Construction.
- 8 CCR, with special attention to Sub Chapter 4, Sections 1500 - 1938 Construction Safety Orders.
- National Institute for Occupational Safety and Health/Occupational Safety and Hazards Administration/U.S. Coast Guard/U.S. Environmental Protection Agency, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Publication No. 85-115, 1985.
- The requirements in this APP also conform to URS's Safety for Life Program requirements as specified in the URS Safety, Health and Environment (SH&E) Manual.
- United States Army Corps of Engineers (USACE). Safety and Health Requirements Manual, EM 385-1-1. 30 November 2014

Personnel Acknowledgement

By signing below, the undersigned acknowledges that he/she has reviewed the URS Accident Prevention Plan for the Security-Widefield sites. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work, and will comply with the provisions contained therein. The employee understands that they are NOT to perform any work that they have not been adequately trained for and that they are to stop work if it is unsafe to proceed. Finally, the employee understands to notify the Site Supervisor and the Incident Hotline at 800-348-5046 for any incident, ***including ANY injury even if no first aid or medical treatment is required.***

[illegible]

Attachment 1 – Activity Hazard Assessments

MOBILIZATION AND DEMOBILIZATION ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC): M

Prepared By: Dustin Gangelhoff Reviewed By: Dennis Day - CIH, CSP

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses, hearing protection, work gloves, and high visibility vest/jacket.

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

E = Extremely High Risk		Probability				
H = High Risk		Frequent	Likely	Occasional	Seldom	Unlikely
M = Moderate Risk						
L = Low Risk						
Severity Rating	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Driving to and from the site from hotel and from one work site to the next.	Driving/Vehicle Movement	1. Obey traffic rules. 2. 15 miles per hour is the maximum speed allowed in the work area. 3. Use caution when entering roadways. 4. Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). 5. Do not use cell phones when operating vehicles. 6. Secure all loads, including equipment within the cab. 7. Wear seat belts, including those provided in cabs of heavy equipment. 8. Use caution and wear orange vests if working near active roads or around heavy equipment. 9. Leave enough time to get to your destination without hurrying. 10. Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; remember that “blind spots” of some equipment can be very large. 11. Conduct a 360 walk around prior to backing up or use a spotter when backing up. 12. Rollover protective structures (ROPS) are required on all heavy equipment with the exception of trucks used for over the road hauling. 13. All equipment will be inspected daily. 14. Refer to S3NA-306 - Highway and Road Work.	18.A 18.C.01 18.C.16 18.B.09 18.B.13	M

**MOBILIZATION AND DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Loading and unloading work vehicle at work site.	Overhead/underground utilities	1. If overhead utilities are present in work areas, place warning signs at ground level. 2. Always check for overhead utilities before using extendable equipment. 3. Maintain at least one mast length or 20 feet (whichever is greater) from all power lines. 4. Contact the SSHO if high voltage lines are present. 5. Complete utility locates prior to intrusive work in areas. 6. Observe the area for indications of utilities.	18.H.06 18.H.06 18.H.03 18.H.07	L
	Noise	1. Wear hearing protection when operating or working near heavy equipment or when using tools that exceed PELs. 2. Refer to S3NA-118 - Hearing Conservation.	05.C.01	L
	Slips, Trips, and Falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings will be recorded on daily inspection reports.	14.D	L
	Material Handling / Lifting	1. Employees should use safe lifting techniques, bending at the knees and lifting with the legs, keep objects close, do not twist. 2. Employees should use caution and not twist the back when carrying a load. 3. Mechanical devices should be used to move loads when possible. 4. Protective gloves should be worn when handling materials. 5. See S3NA-014 - Manual Lifting.	14.A.04 14.A.03 05.H	L
	Cold Stress	1. Cold weather clothing and shelter should be provided as needed based on site conditions. 2. Air temperature monitoring should be done when temperatures fall below 45 degrees F. 3. See S3NA-112 - Cold Stress.	06.J.04 - .06	L
	Heat Stress	1. Drinking water should be made available to all workers and workers should be encouraged to drink small amounts frequently. 2. Work/rest regimens will be adjusted during hot weather. 3. See S3NA-113 - Heat Stress.	06.J.03	M
	Extreme Weather	1. When there are warnings or indications of severe weather, conditions should be monitored and precautions taken to protect personnel.	06.J.01	L

**MOBILIZATION AND DEMOBILIZATION
ACTIVITY HAZARD ANALYSIS**

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Vehicles	Inspect vehicle prior to each use to ensure vehicle is safe to operate, check tires, lights, windshields, mirrors, registration and insurance. Vehicle inspection checklist within S3AM-005-FM2 may be used for inspection. Do not operate vehicle of any obvious safety defects.	All drivers must complete vehicle safety training and the National Safety Council Defensive Driving Course. Review and refer to S3NA-306 Highway and Road Work.
First Aid kits	First Aid kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site.

UTILITY CLEARANCE, SITE INSPECTION, AND SURVEYING

ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO

Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC): **M**

Prepared By: Dustin Gangelhoff

Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:
PPE Level D: General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses or face shield, hearing protection, work gloves, and high visibility vest/jacket.

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Site inspections and land surveying (GPS). Identifying and marking utilities.	Ergonomics	1. Do not strain when using hand tools. 2. Use arms and shoulders; do not twist your back.	14.A 14.A	L
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Do not use damaged tools. 4. Follow S3NA-305-PR1 Hand and Power Tools	13.A.02 13.A.02 13.A.02	L
	Slips, Trips, and Falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings will be recorded on daily inspection reports. 3. Personnel must maintain radio contact with the operator and acknowledge messages. 4. If radio communication is not possible then establish eye contact and use hand signals. 5. All heavy equipment at zero energy state (boom/bucket on ground) with vehicle turned off when sampling from bucket. 6. Stockpiles will be placed at least 5-feet from excavation. 7. Ground personnel not allowed within 5-feet of sidewall.	14.A.04 14.A.03 05.H	M
	Biological Hazards	1. Repellents and proper clothing should be used for protection against insects including ticks, and mosquitoes. 2. Protective clothing should be used in areas where poison plants are present. 3. Protective clothing including long pants, and sturdy boots should be used for protections against snakes and spiders. 4. See S3NA 313 PR1 - Wildlife Plants and Insects.	06.E.01 06.E.02 06.E.01	L

**UTILITY CLEARANCE, SITE INSPECTION, AND SURVEYING
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Site inspections and land surveying (GPS). Identifying and marking utilities.	Underground utilities and compressed air	1. Follow S3AM-331-PR1 Underground Utilities. 2. Wear face shield if using compressed air for utility locate and follow S3AM-337-PR1 Compressed Air Systems & Testing.	20.B 25.A.01 25.A.10	L
	Working adjacent highways, roads, or railroads.	1. Follow S3NA-306-PR1 Highways and Road Work. 2. Follow S3NA-329-PR1 Railroad Safety.	18.C	L
	Cold Stress	1. Cold weather clothing and shelter should be provided as needed based on site conditions. 2. Air temperature monitoring should be done when temperatures fall below 45 degrees F. 3. See S3NA 112-PR1 - Cold Stress.	06.J.04 - .06	L
	Heat Stress	1. Drinking water should be made available to all workers and workers should be encouraged to drink small amounts frequently. 2. Work/rest regimens will be adjusted during hot weather. 3. See S3NA 113-PR1 - Heat Stress.	06.J.03 06.J.04	M
	Extreme Weather	1. When there are warnings or indications of severe weather, conditions should be monitored and precautions taken to protect personnel.	01.E.01	L
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS		
Vehicles	Inspect vehicle prior to each use to ensure vehicle is safe to operate, check tires, lights, windshields, mirrors, registration and insurance. Vehicle inspection checklist S3NA 005 FM2 may be used for inspection. Do not operate vehicle of any obvious safety defects.	All drivers must complete vehicle safety training and the National Safety Council Defensive Driving Course. Review and refer to S3NA 005 PR1 - Driving.		
Power tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor and authorized to use power tools.		
Hand tools	Trained by site supervisor.	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.		
First Aid kits	First Aid kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site.		

DIRECTIONAL BORING ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO

Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC):

H

Prepared By: Dustin Gangelhoff

Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses, hearing protection, work gloves, high visibility vest/jacket, and nitrile gloves (when handling potentially contaminated materials and samples).

Probability

Frequent	Likely	Occasional	Seldom	Unlikely
E	E	H	H	M
E	H	H	M	L
H	M	M	L	L
M	L	L	L	L

S
e
v
e
r
i
t
y

Catastrophic
Critical
Marginal
Negligible

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Raise mast	Rig stability Wind	1. Refer to S3NA-321-PR, Drilling, Boring & Direct Push Probing. 2. Situate the rig on a flat surface. 3. Use outriggers as necessary. 4. Never move the rig with the mast up. 5. Monitor wind speed. Shut down work if drilling mast is unstable due to wind.	18.H.08 18.H.08 18.H.07	M
	Overhead utilities Wind	1. If over head utilities are present in work areas, place warning signs at ground level. 2. Always check for overhead utilities before raising the mast. 3. Maintain at least one mast length or 20 feet, whichever is greater, from all power lines (account for wind swaying of lines). 4. Contact the SSHO if high voltage lines are present. 5. Refer to S3NA-322 - Overhead Lines.	18.H.06 18.H.06 18.H.06	H
Attach/detach rod and augers	Lifting	1. Use mechanical lifting equipment and/or get help when moving heavy objects. 2. Use proper lifting techniques: a. Bend at the knees; do not use your back. b. Keep objects close to your body. c. Do not twist.	14.A 14.A 14.A 14.A	M
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools. 4. Push don't pull wrenches.	13.A.02 13.A.02 13.A.02	M
	Pinch points	1. Never place your hand or other body parts under attached rods, hydraulic ram, or boot of the direct push unit.	16.A.13	H

**DIRECTIONAL BORING
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Drilling Working adjacent highways, roads, or railroads.	Rotating equipment	1. Assure that all team members know the location of the kill switch. Document in the initial on-site training. 2. Stand clear, if possible. 3. Do not wear loose clothing, jewelry, hair, or equipment near the auger. 4. Have minimum of two persons present when advancing the auger. 5. Remove cuttings with a shovel, not your hand or foot.	18.H.10	M
	Moving vehicles or trains	1. Follow S3NA-306-PR1 Highways and Road Work. 2. Follow S3NA-329-PR1 Railroad Safety.	18.C	L
	Underground utilities	1. Complete utility locates prior to drilling. 2. Mark locations in white. 3. Field verify utility locations. 4. Document all utility locates. 5. Observe the area for indications of utilities. 6. Refer to S3NA-331 - Underground Utilities. 7. Complete 3-point hand augers to 5 feet bgs for utility clearance when practical.	18.H.03	M
	Environmental Contamination (if applicable)	1. Contain cuttings in drums or plastic sheeting. 2. Wear proper PPE and minimize contact with soil, sediment, groundwater, etc. 3. Work upwind of the boring. 4. If unusual soil discoloration or odors are encountered, stop work, evacuate the area, and contact the SSHO. The approach will need to be reevaluated, and Level C PPE may be required.	06.A.01 06.A.03 06.A.04	L
	Dust	1. Minimize generation of dust. 2. Stay out of visible dust clouds. 3. Wet soil if necessary to eliminate visible dust.	06.N	L
	Noise	1. Wear hearing protection when operating or working near heavy equipment or using tools that exceed the PEL. 2. Refer to S3NA-118 - Hearing Conservation.	05.C.01	L

**DIRECTIONAL BORING
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Drilling equipment maintenance	Slips, Trips, and Falls	1. Make sure you have a good solid footing and that walking/working surfaces are as clean and dry as possible.	14.D	L
	Equipment energization	1. Lockout and tagout is required if accidental energization of the rig could cause injury. 2. Refer to S3NA-325-PR, Lockout Tagout.	12E	M
	Hot work	1. Clear all combustibles away from the work area. 2. A fire extinguisher must be available. 3. Notify the site superintendent of all hot work. 4. Observe work areas for 30 minutes after hot work ("fire watch"). 5. Refer to S3NA-332-PR, Hot Work.	10.D.02 10.D.02 09.K.03	M
	Chemical Hazards	1. Review material safety data sheets. 2. Follow manufacturer's instructions for use, handling and storage. 3. Use recommended protective equipment. 4. Label all containers.	06.B 06.A.04 06.B	L
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS		
Drilling Equipment (Type To Be Determined)	Perform a pre-shift inspection of all equipment. Identify power kill safety switch to all workers in the area.	Follow requirement of the Site Safety and Health Plan.		
Vehicles	Inspections vehicle prior to each use to ensure vehicle is safe to operate, check tires, lights, windshields, mirrors, registration and insurance. Vehicle inspection checklist within S3NA-005-PR may be used for inspection. Do not operate vehicle of any obvious safety defects.	All drivers must complete LMS vehicle safety training and the National Safety Council Defensive Driving Course. Review and refer to S3NA-005-PR, Driving.		
Continuous sampler, augers, geotechnical sampling supplies.	Perform a pre-shift inspection of all equipment.	Employees must be trained to use personal protective equipment specified in the SSHP. Hazard communication training is required where there is a potential for exposure to hazardous substances; refer to S3NA-115-PR, Hazardous Materials Communication.		
Power tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor and authorized to use power tools.		
Hand tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor.		
First aid kits	First Aid Kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site		
Fire extinguisher	Inspect extinguishers monthly.	All workers will be trained in the proper use of portable fire extinguishers.		

EXCAVATION AND TRENCHING ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC):

M

Prepared By: Dustin Gangelhoff Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses, hearing protection, work gloves, high visibility vest/jacket, and nitrile gloves (when handling potentially contaminated materials and samples).

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Mechanical Excavation	Trench or excavation failure	1. Slope excavations (assuming a soil type "C" and the slope will be 1.5 horizontal to 1 vertical) when excavations exceed 4 feet and whenever excavations are to be entered by workers. 2. The OSHA Competent person will conduct and document an excavation inspection prior to entrance by workers. Document with S3NA-303-FM1 Daily Excavation Checklist. 3. Provide proper ingress and egress. Follow S3NA-303 Excavation. 4. Prepare an Excavation Plan in accordance with 385-1-1 Section 25 if excavation greater than 5 feet in depth	25.C.01	M
Mechanical Excavation	Injury from vehicle and heavy equipment traffic in work area	1. Remain out of the swing radius of excavating equipment 2. Only approach equipment after excavator's bucket is lowered to the ground and attention of the equipment operator has been obtained 3. Use spotter when backing 4. Maintain back up alarms on all heavy equipment 5. Stop equipment operation if unauthorized personnel enter the work zone 6. Use spotter and maintain safe distance if overhead power lines are in the vicinity of the work area 7. Establish Vehicle routes, separate people and vehicle traffic. 8. Follow S3NA-309 Heavy Equipment and S3NA-306 Highway & Road Work	18.G	M

**EXCAVATION AND TRENCHING
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Set up work area EZ and CRZ. Layout limits of excavation. Place in temporary piles in designated stockpile area. Cover with additional plastic at the end of the day cover if wind causes generation of visible dust.	Impact/injury from heavy equipment or moving loads Vehicle accidents/collisions	1. Vehicle and equipment operators will look in the direction of travel; will look before backing up. 2. Arrange traffic flow to prevent foot traffic from crossing the routes of heavy equipment and moving loads. 3. Vehicle operators and pedestrians will acknowledge each others presence prior to the pedestrian walking near equipment / vehicles / tools in operation. 4. Disengage equipment when not in use. 5. Wear high visibility traffic safety vests when working around heavy equipment/ moving vehicles.	18.A – 18.E 05.F	 M
Mechanical excavation. Temporary stockpiling of materials Dust suppression. Decontamination of heavy equipment.	Exposure to dust or unsuspected site contaminants.	1. Work upwind of the equipment. 2. If unusual soil discoloration or odors are encountered, stop work, evacuate area and contact SSHO; approach will need to be re-evaluated and Level C PPE may be required. 3. Perform air monitoring for total dust. If only total dust action level is exceeded, upgrade to Level C respiratory protection. Consider changes in work practices (e.g., dampen excavation area slightly, minimize area being excavated and disturbed at any one time, cover stockpiles, provide equipment operators with enclosed equipment cabs). 5. Stockpiles will be placed at least 5-feet from excavation. 6. Ground personnel not allowed within 5-feet of sidewall.	06.N	 M
Drilling equipment maintenance	Slips, Trips, and Falls	1. Make sure you have a good solid footing and that walking/working surfaces are as clean and dry as possible.	14.A.04	L
	Equipment energization	1. Lockout and tagout is required if accidental energization of the rig could cause injury. 2. Refer to S3NA-325-PR, Lockout Tagout.	12E	M
	Hot work	1. Clear all combustibles away from the work area. 2. A fire extinguisher must be available. 3. Notify the site superintendent of all hot work. 4. Observe work areas for 30 minutes after hot work (“fire watch”). 5. Refer to S3NA-332-PR, Hot Work.	10.D.02 10.D.02 09.K.03	 M
	Chemical Hazards	1. Review material safety data sheets. 2. Follow manufacturer’s instructions for use, handling and storage. 3. Use recommended protective equipment. 4. Label all containers.	06.B 06.A.04 06.B	 L

**EXCAVATION AND TRENCHING
ACTIVITY HAZARD ANALYSIS**

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Heavy equipment Excavator. Specifications to be determined	Daily Equipment Pre-Operation Checklist - S3NA-309-FM2. Daily Excavation Checklist -S3NA-303-FM1	Heavy equipment operators will be qualified and complete a Heavy Equipment Skill Evaluation - S3NA-309-FMX.
Power tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor and authorized to use power tools.
Hand tools	Trained by site supervisor.	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.
First aid kits	First Aid Kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site
Fire extinguisher	All workers will be trained in the proper use of portable fire extinguishers.	Inspect extinguishers monthly.

CONSTRUCTION ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO

Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC):

H

Prepared By: Dustin Gangelhoff

Reviewed By: Dennis Day - CIH, CSP

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses or face shield, hearing protection, work gloves, high visibility vest/jacket, and nitrile gloves (when handling potentially contaminated materials and samples).

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Groundwater treatment plant construction to include: Ground preparation for trailer pad, dumpster, and sanitary Electricity connection to trailer Preparation of construction area, subgrade, concrete work Building construction Electrical wiring Plumbing Process equipment installation	Driving/Vehicle Movement (including trucks, heavy equipment)	<ol style="list-style-type: none"> Obey traffic rules. 15 miles per hour is the maximum speed allowed in the work area. Use caution when entering roadways. Do not operate vehicles in unsafe conditions (e.g., on steep slopes, in deep mud). Do not use cell phones when operating vehicles. Secure all loads, including equipment within the cab. Wear seat belts, including those provided in cabs of heavy equipment. Use caution and wear orange safetyvests if working near active roads or around heavy equipment. Leave enough time to get to your destination without hurrying. Be aware of heavy equipment and do not park or conduct work in the blind spot of the equipment operator; remember that "blind spots" of some equipment can be very large. Verify back-up alarms are functional for all heavy equipment for pick-ups or SUVs with obstructed rear view, a back-up alarm or use a spotter when backing up. Rollover protective structures (ROPS) are required on all heavy equipment with the exception of trucks used for over the road hauling. Equipment shall be inspected and maintained according the manufacturer's recommendations. See S3NA-309-PR Heavy Equipment, S3NA-306-PR Highway & Road Work, and S3NA-005-PR Driving. 	<p>18.A 18.C.01 18.C.16 18.B.09 18.B.13</p>	H

**CONSTRUCTION
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Groundwater treatment plant construction to include: Ground preparation for trailer pad, dumpster, and sanitary Electricity connection to trailer Preparation of construction area, subgrade, concrete work Building construction Electrical wiring Plumbing Process equipment installation	Overhead/underground utilities	1. If overhead utilities are present in work areas, place warning signs at ground level. 2. Always check for overhead utilities before using extendable equipment. 3. Maintain at least one mast length or 20 feet (whichever is greater) from all power lines. 4. Contact the Colorado Springs Utilities if high voltage lines are present. 5. Complete utility locates prior to intrusive work in areas where utilities have not been cleared through institutional knowledge by calling (One Call: 811 and/or coordinate with site personnel). 6. Observe the area for indications of utilities.	18.H.06	M
	Dust	1. Minimize generation of dust. 2. Stay out of visible dust clouds. 3. Wet soil if necessary to eliminate visible dust.	06.N	M
	Noise	1. Wear hearing protection when operating or working near heavy equipment or using tools that exceed the PEL. 2. Refer to S3NA-118-PR, Hearing Conservation.	05.C.01	L
	Electricity	1. Electrical work shall be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements. 2. See S3NA-302-PR Electrical Safety	11.A.01	H
	Slips, Trips, and Falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings shall be recorded on daily inspection reports.	14.D	L
	Concrete work hazards	1. Concrete work shall be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements. 2. See S3NA-338-PR Concrete.		M
	Building construction hazards	1. Construction work shall be performed by qualified personnel with verifiable credentials who are familiar with applicable code requirements.		H
	Hand tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools. 4. Push, don't pull wrenches.	13.A.02 13.A.02 13.A.02	M

**CONSTRUCTION
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Groundwater treatment plant construction to include: Ground preparation for trailer pad, dumpster, and sanitary Electricity connection to trailer Preparation of construction area, subgrade, concrete work Building construction Electrical wiring Plumbing Process equipment installation	Biological Hazards	1. Repellents and proper clothing should be used for protection against insects including ticks, and mosquitoes. 2. Protective clothing should be used in areas where poison oak and poison ivy are present. 3. Protective clothing including long pants, and sturdy boots should be used for protections against snakes and spiders. 4. See S3NA-313-PR Wildlife, Plants & Insects.	06.E.01 06.E.02 06.E.01	L
	Material Handling	1. Employees should use safe lifting techniques, bending at the knees and lifting with the legs. 2. Employees should use caution and not twist the back when carrying a load. 3. Mechanical devices should used to move loads when possible. 4. Protective gloves should be worn when handling materials. 5. See S3NA-343-PR Hoists, Elevators & Conveyors	14.A.01 14.A.03 05.H	L
	Cold Stress	1. Cold weather clothing and shelter should be provided as needed based on site conditions. 2. Air temperature monitoring should be done when temperatures fall below 45 degrees F. 3. See S3NA-112-PR Cold Stress.	06.J.04 - .06	M
	Heat Stress	1. Drinking water should be made available to all workers and workers should be encouraged to drink small amounts frequently. 2. Work/rest regimens shall be adjusted during hot weather. 3. See S3NA-113-PR Heat Stress.	06.J.03 06.J.04	L
	Extreme Weather	1. When there are warnings or indications of severe weather, conditions should be monitored and precautions taken to protect personnel.	01.J.01	L
	Fire	1. Portable fire extinguishers shall be present in all equipment and in the field trailer. 2. Fire extinguishers shall be inspected monthly. 3. Hot work permits must be obtained prior to any welding or torch cutting activities.	09.F 09.F 09.A.04	L
	Temporary Facilities	1. Trailers shall be anchored with rods and cables or by steel straps to ground anchors designed to withstand winds and meet applicable standards. 2. Signs warning of the presence of construction hazards and requirements should be posted on the fencing every 300 feet. 3. One portable toilet with adequate ventilation and (natural) light shall be on site. 4. Washing facilities shall be provided at the portable toilet location to maintain sanitary conditions. 5. Type II 16-unit first aid kits shall be present and accessible at the site.	04.A.03 04.A.04 02.E 02.E 03.B	L

**CONSTRUCTION
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Groundwater treatment plant construction to include: Ground preparation for trailer pad, dumpster, and sanitary Electricity connection to trailer Preparation of construction area, subgrade, concrete work Building construction Electrical wiring Plumbing Process equipment installation	Power Machine Tools	1. Power tools shall be used, inspected, and maintained according to manufacturer's recommendations. 2. Power tools designed to accommodate guards shall be equipped with such guards. 3. The electrical power control shall be provided on each power tool to make it possible for the operator to cut off the power without leaving the point of operation. 4. All electrical power tools should be connected to an in-line GFCI.		L
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS		
Heavy equipment (grading, earth moving, concrete pouring, material handling) (Types To Be Determined)	Perform a pre-shift inspection of all equipment. Identify power kill safety switches to all workers in the area.	Follow requirement of the Site Safety and Health Plan.		
Vehicles	Inspections vehicle prior to each use to ensure vehicle is safe to operate, check tires, lights, windshields, mirrors, registration and insurance. Vehicle inspection checklist S3NA-005-PR may be used for inspection. Do not operate vehicle of any obvious safety defects.	All drivers must complete LMS vehicle safety training and the National Safety Council Defensive Driving Course. Review and refer to S3NA-005-PR, Driving.		
Power tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor and authorized to use power tools.		
Hand tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor.		
First aid kits	First Aid Kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site		
Fire extinguisher	Inspect extinguishers monthly.	All workers will be trained in the proper use of portable fire extinguishers.		

GROUNDWATER SAMPLING ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC): **L**

Prepared By: Dustin Gangelhoff Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, safety glasses, work gloves, and nitrile gloves (when handling potentially contaminated materials and samples).

Severity	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Groundwater sampling (indoor treatment system)	Ergonomics / Lifting	1. Do not strain when collecting the sample. 2. Use arms and shoulders; do not twist your back. 2. Use proper lifting techniques: a. Bend at the knees; do not use your back. b. Keep objects close to your body. c. Do not twist.	14.A.01	L
Equipment decontamination	Hand Tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools. 4. Push, don't pull wrenches.	13.A.02	L
Sample shipping	Environmental Contamination	1. Wear proper PPE and minimize contact with groundwater. 2. Follow all provisions of this SSHP.	06.A.01-04	L
	Chemical Hazards	1. Review the chemical preservatives in all sample containers and review SDSs, if needed. 2. Use recommended protective equipment, including chemical-resistant gloves and safety glasses with side shields.	06.B	L
	Slips, Trips, and Falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings will be recorded on daily inspection reports.	14.D	L

**GROUNDWATER SAMPLING
ACTIVITY HAZARD ANALYSIS**

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
Sampling equipment (containers, coolers, etc.)	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	All samplers must be 40-hour HAZWOPER trained (with annual refresher). Review and refer to S3NA-115-PR - Hazardous Materials Communication.
Hand tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor.
First aid kits	First Aid Kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site
Fire extinguisher	Inspect extinguishers monthly.	All workers will be trained in the proper use of portable fire extinguishers.

DECONTAMINATION ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO

Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC):

M

Prepared By: Dustin Gangelhoff

Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, hard hat, safety glasses or face shield, hearing protection, work gloves, high visibility vest/jacket, and nitrile gloves (when handling potentially contaminated materials and samples).

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JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Scrape gross materials from sampling equipment (if used for investigative HTRW sampling). Wash sampling equipment in Alconox/Liquinox and water mix (if collecting for investigative HTRW sampling). Rinse sampling equipment in clean rinse water (if used for investigative HTRW sampling). Triple rinse sampling equipment with deionized water (if used for investigative HTRW sampling).	Eye and hand safety	1. Wear safety glasses or goggles. 2. Use hands with protective gloves or approved hand tools to remove gross material. 3. Change protective gloves often.	05.B	L
	Noise	1. Wear hearing protection when operating or working near heavy equipment. 2. Refer to S3NA-118-PR, Hearing Conservation.	05.C.01	L
	Slips, Trips, and Falls	1. Make sure you have good solid footing and that walking/working surfaces are as clean and dry as possible. 2. Work areas should be inspected daily and findings will be recorded on daily inspection reports.	14.D	L
	Hand Tools	1. Inspect tools prior to use. 2. Use tools for their intended use only. 3. Don't use damaged tools. 4. Push, don't pull wrenches.	13.A.02 13.A.02 13.A.02	L
	Material Handling / Lifting	1. Employees should use safe lifting techniques, bending at the knees and lifting with the legs, keep close to body, do not twist 2. Employees should use caution and not twist the back when carrying a load. 3. Mechanical devices should be used to move loads when possible. 4. Protective gloves should be worn when handling materials. 5. See S3NA-014-PR, Manual Lifting.	14.A.04 14.A.03 05.A	L

**DECONTAMINATION
ACTIVITY HAZARD ANALYSIS**

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	14.A.04	RAC
Scrape gross materials from sampling equipment (if used for investigative HTRW sampling).	High pressure washing	1. High pressure water/steam sprayers or cleaners will be used and handled as directed by the manufacturer. 2. Hands will not be cleaned using this equipment. 3. Pressure washing equipment will be directed away from the body and other personnel in the area. 4. Never allow the nozzle of a pressurized tool to come in contact with any part of the body while operating. 5. See S3NA-305-ATT9, Pressure Washer.	05.H	M
Wash sampling equipment in Alconox/Liquinox and water mix (if collecting for investigative HTRW sampling).				
Rinse sampling equipment in clean rinse water (if used for investigative HTRW sampling).	Cold Stress	1. Cold weather clothing and shelter should be provided as needed based on site conditions. 2. Air temperature monitoring should be done when temperatures fall below 45 degrees F. 3. See S3NA-112-PR, Cold Stress.	06.J.04 - .06	L
Triple rinse sampling equipment with deionized water (if used for investigative HTRW sampling).	Heat Stress	1. Drinking water should be made available to all workers and workers should be encouraged to drink small amounts frequently. 2. Work/rest regimens will be adjusted during hot weather. 3. See S3NA-113-PR, Heat Stress.	06.J.03	M
	Extreme Weather	1. When there are warnings or indications of severe weather, conditions should be monitored and precautions taken to protect personnel.	01.E.01	L
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS		
Hand Tools	Power tools will be used, inspected and maintained according to manufacturer's recommendations.	HAZWOPER training for all personnel. Equipment will be operated only by a designated qualified person. All personnel will attend the site safety briefings.		
Vehicles	Inspect vehicle prior to each use to ensure vehicle is safe to operate, check tires, lights, windshields, mirrors, registration and insurance. Vehicle inspection checklist S3NA 005 FM2 may be used for inspection. Do not operate vehicle of any obvious safety defects.	All drivers must complete vehicle safety training and the National Safety Council Defensive Driving Course. Review and refer to S3NA 005 PR1 - Driving.		
Electrical Equipment (To Be Determined)	All electrical equipment will be inspected prior to use.	Equipment will be operated only by a designated qualified person. All personnel will attend the site safety briefings. Review equipment user manuals.		
Power tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor and authorized to use power tools.		
Hand tools	Inspect daily for broken / damaged parts. Any equipment found defective will be taken out of service and replaced immediately.	Trained by site supervisor.		
First aid kits	First Aid Kits will be inspected weekly for damage and/or missing items which will be replaced immediately.	A minimum of 2 individuals trained in CPR/First Aid will be on-site		
Fire extinguisher	Inspect extinguishers monthly.	All workers will be trained in the proper use of portable fire extinguishers.		

SITE RESTORATION ACTIVITY HAZARD ANALYSIS

Date Prepared: October 22, 2018

Project: Security-Widefield, CO

Job: PFC/PFAS Mitigation and Sampling

Risk Assessment Code (RAC):

M

Prepared By: Dustin Gangelhoff

Reviewed By: Dennis Day - CIH, CSP

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Recommended Protective Clothing and Equipment:

PPE Level D:

General work clothes, safety-toed boots with non-porous uppers, and work gloves (when loading and unloading). When outside the office trailers: Safety glasses. Hard hat. Orange/yellow safety vest.

PPE as discussed in other worksheets and SSHP

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Catastrophic

Critical

Marginal

Negligible

Probability

Frequent	Likely	Occasional	Seldom	Unlikely
E	E	H	H	M
E	H	H	M	L
H	M	M	L	L
M	L	L	L	L

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	EM 385-1-1 (PARA REF)	RAC
Site Restoration: Scrap out flat, drill seed	Heavy Equipment Use	1. Disengage equipment when not in use. 2. Maintain a safe distance from clearing and grubbing equipment to avoid flying debris.		M
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS		
Heavy equipment (dozer or similar)	Daily Equipment Pre-Operation Checklist - S3NA-309-FM2. Daily Excavation Checklist -S3NA-303-FM1	Heavy equipment operators will be qualified and complete a Heavy Equipment Skill Evaluation - S3NA-309-FMX.		
Tractor w/ impliment	Inspect vehicle prior to each use to ensure vehicle is safe to operate, brakes, check tires, lights, windshields, mirrors, seat belts, gauges.	CDL Drivers License. Operators will be trained in the safe use of required equipment. Complete S3NA-309-FM4 Scraper Operator Skill Evaluation		

Attachment 2 – Procedures

All URS SH&E Procedures, in their controlled copy version, are available on the internal SH&E Policy and Procedures Ecosystem page.

	Hazard/ Activity <i>(note: text in this column links to procedure)</i>	Site Specific Description <i>[where, what phase of work, frequency, etc.]</i>	Applicable Procedure
<input checked="" type="checkbox"/>	Cold Stress	Laying conveyance piping and WTP construction (depending on season)	S3AM-112
<input checked="" type="checkbox"/>	Compressed Air Systems and Testing	Utility locate	S3AM-337
<input checked="" type="checkbox"/>	Concrete Work	Laying conveyance piping and WTP construction	S3AM-338
<input checked="" type="checkbox"/>	Cranes and Lifting Devices	Laying conveyance piping and WTP construction	S3AM-310
<input checked="" type="checkbox"/>	Drilling, Boring & Direct Push Probing	Laying conveyance piping	S3AM-321
<input checked="" type="checkbox"/>	Electrical Safety	WTP construction	S3AM-302
<input checked="" type="checkbox"/>	Excavation	Laying conveyance piping	S3AM-303
<input checked="" type="checkbox"/>	Fall Protection	Laying conveyance piping and WTP construction	S3AM-304
<input checked="" type="checkbox"/>	Flammable and Combustible Liquids	Laying conveyance piping and WTP construction	S3AM-126
<input checked="" type="checkbox"/>	Hand and Power Tools	Laying conveyance piping and WTP construction	S3AM-305
<input checked="" type="checkbox"/>	Hazardous Waste Operations	Laying conveyance piping, WTP construction, and WTP sampling	S3AM-117
<input checked="" type="checkbox"/>	Heat Stress	Laying conveyance piping and WTP construction (depending on season)	S3AM-113
<input checked="" type="checkbox"/>	Heavy Equipment	Laying conveyance piping and WTP construction	S3AM-309
<input checked="" type="checkbox"/>	Highway and Road Work	Laying conveyance piping	S3AM-306
<input checked="" type="checkbox"/>	Hot Work	Laying conveyance piping and WTP construction	S3AM-332
<input checked="" type="checkbox"/>	Ladders	WTP construction	S3AM-312
<input checked="" type="checkbox"/>	Lockout Tagout	Laying conveyance piping and WTP construction	S3AM-325
<input checked="" type="checkbox"/>	Overhead Lines	Laying conveyance piping and WTP construction	S3AM-322
<input checked="" type="checkbox"/>	Powder-Actuated Tools	WTP construction	S3AM-327
<input checked="" type="checkbox"/>	Powered Industrial Trucks	Laying conveyance piping and WTP construction	S3AM-324
<input checked="" type="checkbox"/>	Railroad Safety	Laying conveyance piping	S3AM-329
<input checked="" type="checkbox"/>	Temp. Floors, Stairs, Railings, Toe-boards	Laying conveyance piping and WTP construction	S3AM-342
<input checked="" type="checkbox"/>	Underground Utilities	Laying conveyance piping and WTP construction	S3AM-331
<input checked="" type="checkbox"/>	Wildlife, Plants and Insects	Laying conveyance piping and WTP construction	S3AM-313

Cold Stress

S3AM-112-PR1

1.0 Purpose and Scope

- 1.1 To protect employees from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all employees can be repeatedly exposed without adverse health effects.
- 1.2 This procedure applies to all AECOM Americas based employees and operations working outdoors in damp and cool (below 50 degrees Fahrenheit [°F] or 10 degrees Celsius [°C]) conditions or anytime temperatures are below 32°F or 0°C.

2.0 Terms and Definitions

- 2.1 **Cold Stress** – The production of physiological effects due to cold temperatures and/or wind chill.
- 2.2 **Equivalent Chill Temperature (ECT)** – Also known as Wind Chill (see below).
- 2.3 **Frostnip** – Superficial cooling of tissues without cellular destruction.
- 2.4 **Frostbite** – Freezing of tissue, resulting in tissue destruction.
- 2.5 **Hypothermia** – Condition of reduced core body temperature to 95°F (35°C) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.
- 2.6 **Wind Chill** – The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-128-PR1 Medical Screening & Surveillance Program
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM-314-PR1 Working Alone
- 3.5 S3AM-315-PR1 Working On or Near Water
- 3.6 S3AM-333-PR1 Marine Safety & Vessel Operations

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager

- Ensuring the safety of employees on their project sites, consistent with regulatory standards.
- Implement cold stress prevention measures as applicable at each work site.
- Develop/coordinate a work-warning regimen, as applicable.
- Confirm cold stress hazard assessments/evaluations were completed for the planned activities.
- Assign employees physically capable of performing the assigned tasks. Consider acclimation to cold weather when evaluating employee capability.
- Confirm employees are properly trained to recognize the symptoms of cold stress.

4.1.2 **Safety, Health and Environment (SH&E) Manager**

- Conduct/support cold stress assessments/evaluations.
- Conduct/support incident investigations related to potential cold stress-related illnesses.
- Assist project teams develop appropriate work-warming regimens.
- Provide cold stress awareness training.

4.1.3 **Supervisor**

- Identify the tasks that may be most impacted by cold stress and communicate the hazard to the assigned employees.
- Confirm that employees have been trained on the recognition of cold stress-related illnesses.
- Confirm that adequate supplies of warm fluids/drinks are readily available to employees.
- Confirm that a warm/sheltered rest area is available, as applicable.
- Conduct cold stress monitoring, as applicable.
- Implement the work-warming regimen.
- Confirm that first aid measures are implemented once cold stress symptoms are identified.
- Confirm that employees are physically capable of performing the assigned tasks and are not in a physically compromised condition.

4.1.4 **Employee**

- Observe each other for the early symptoms of cold stress-related illnesses.
- Maintain an adequate intake of available fluids.
- Report to work in a properly rested condition.
- Report all suspected cold stress-related illnesses.

4.2 **Requirements**

- 4.2.1 Carefully plan work anticipated to be performed in cool or cold conditions. If possible, heavy work should be scheduled during the warmer parts of the day or when the wind is most calm. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.
- 4.2.2 Staff working in extreme cold (wind chill or ECT below 10°F or -12°C) shall not work alone. The Buddy System shall be utilized to keep an eye on each other and to watch for signs of cold stress. Refer to *S3AM-314-PR1 Working Alone*. Watch for symptoms and signs of hypothermia.
- 4.2.3 Monitor weather forecasts and weather conditions such as ambient temperature, wind speed, and precipitation. Use observations prior to entering and while in the field to ensure appropriate protections are in place:
- If possible, move the work to a warm location.
 - If possible and as applicable, erect shelters or screens around the work area.
 - If possible, heat the work area.
 - If possible, adjust schedule according to the cold conditions, work level and worker acclimatization.
 - Implement a work-warming regimen by taking breaks out of the cold. As applicable, consult *S3AM-112 ATT1 Temperature Thresholds* to determine wind chill and work-warming schedule.
 - Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure to the cold. If shelter is not readily available, consider supplying temporary shelters.

- Provide assistance to prevent body heat loss, such as:
 - Providing appropriate sources of heat (e.g. warm packs, portable heaters, etc.).
 - Use of insulating materials on equipment handles when temperatures drop below 30°F (-1°C).

4.2.4 All staff working in extreme cold or snow conditions should understand the following guidelines for preventing and detecting hypothermia and frostbite; refer to *S3AM-112-ATT2 Symptoms & Treatment*:

- Ensure appropriate PPE requirements are established and adhered to.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Because prolonged exposure to cold air or to immersion in cold water at temperatures even well above freezing can lead to dangerous hypothermia, whole-body protection shall be used.
- Eat high calorie snacks to help maintain body metabolism.
- Confirm extra blankets or sleeping bags are on-site.
- Drink plenty of warm liquids. It is easy to become dehydrated in cold weather.
- Avoid caffeine and alcohol, which can act as diuretics. Alcohol consumption, depending upon quantity, can dilate blood vessels enhancing body heat loss or constrict blood vessels decreasing heat delivery to extremities.
- NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.
- If you experience frost bite or hypothermia, find shelter and warmth and contact a medical practitioner if symptoms persist, refer to *S3AM-128-PR1 Medical Screening & Surveillance*.

4.3 Training

Before they begin work in a cold environment, employees that might be exposed to cold stress will be informed of the potential for cold stress and how to prevent cold stress. Employees that have not had the training within the twelve prior months shall repeat the training before exposure to cold stress, refer to *S3AM-003-PR1 SH&E Training*. Employees potentially exposed to cold stress will receive training including, but not limited to:

- 4.3.1 Sources of cold stress, the influence of protective clothing, and the importance of acclimatization.
- 4.3.2 How the body loses heat.
- 4.3.3 Recognition of cold-related illness symptoms.
- 4.3.4 Cold stress preventative/corrective measures including, but not limited to:
 - Weather monitoring.
 - Proper eating and drinking practices.
 - Work-warming schedules and proper re-warming techniques.
 - Buddy system.
 - Safe cold work practices appropriate to the work that is to be performed.
 - Proper use of cold environment personal protective clothing.
- 4.3.5 The harmful effects of excessive alcohol consumption in a cold stress environment.
- 4.3.6 The hazards associated with unstable snow or ice build ups.
- 4.3.7 First aid procedures for symptoms related to cold stress.

4.4 Personal Protective Equipment (PPE)

Wearing the right clothing is crucial to avoiding cold stress. The type of fabric also makes a difference. Cotton loses its insulation value when it becomes wet. Wool, on the other hand, retains its insulation even when wet. Adequate insulating dry clothing will be required in air or wind chill temperatures below 40 °F (4.4°C)

All PPE will comply with the requirements of *S3AM-208-PR1 Personal Protective Equipment* and consider the following requirements:

- 4.4.1 Wear at least 3 layers of clothing to help prevent cold stress. It is important to preserve the air space between the body and the outer layer of clothing to retain body heat.
 - Wear a middle layer of down, wool, or similar materials to provide insulation.
 - Avoid cotton, especially blue jeans.
 - Wear an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
 - Do not wear tight clothing. Loose clothing allows better ventilation.
- 4.4.2 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.
- 4.4.3 Wear a hat or hardhat liner. Up to 40 percent of body heat can be lost when the head is left exposed.
- 4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.
- 4.4.5 Wear insulated boots or other insulated footwear, and insulated gloves to help reduce the chance of frostbite.
- 4.4.6 Keep a change of dry clothing available in case work clothes become wet.
- 4.4.7 Eye and face protection for employees employed outdoors in a snow and/or ice-covered terrain should be supplied.
 - Sunglasses (with UVA and UVB protection) and sunscreen should be used when there is a persistent combination of snow and direct sun.
 - Special safety goggles to protect against blowing ice crystals and ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.
 - Ensure face guards are used to protect skin in cold, windy conditions, including riding on an unshielded vehicle.

4.5 General Cold Stress Prevention Measures

- 4.5.1 In order to prevent hypothermia:
 - Wear appropriate clothing and PPE as determined by the weather conditions.
 - When active, ventilate excess heat by opening or removing outer layers of clothing to avoid sweating.
 - Start with the mitten or gloves, unless protection from ice, snow, or cold metal surfaces is needed.
 - Next remove head gear and neck wrappings.
 - Then coats/parkas should be opened at the waist and sleeves.
 - Finally, layers of clothing should be taken off.
 - When resting or tired, or colder conditions are encountered, add additional layers of clothing/ close outer layers in the reverse of the above order, or get out of the cold. Have a sweet drink but do not indulge in heavy eating.

- Garments worn to keep out rain and spray should also allow water vapor to escape.
- Take advantage of heat from the sun and stay out of the wind as much as possible.
- Have available emergency shelter providing protection from wind and rain and insulation from the ground.
- Replace wet clothing. If wet clothing cannot be replaced, then cover it with a layer of non-breathing material to prevent evaporation. Place an insulation layer over this non-breathing material.
- Get adequate rest; conserve energy.
- Get adequate nutrition to replenish energy stores; rest after meals.
- Drink adequate fluids to avoid dehydration.
- If any project / location staff member shows signs of hypothermia, stop and treat him/her.

4.5.2 In order to prevent frost bite:

- Dress to prevent hypothermia and protect the feet and hands.
- Avoid obstruction of circulation by, for example, tight boots or tightly fitting clothing.
- Avoid nicotine (particularly cigarettes) and do not consume alcohol.
- Keep ears and nose covered and out of the wind.
- Frostbite of the corneas of the eyes can be prevented by protective goggles.
- Adopt a "buddy system" of constantly watching the faces of others in the party for white skin tissue, which is evidence of frostbite (frostnip).
- Practice constant personal vigilance for signs of trouble in one's own fingers and toes; when in doubt, investigate thoroughly before it is too late.

4.5.3 Adequate, insulating dry clothing that will help maintain core temperatures above 96.8°F (37°C) shall be provided to employees if work is performed in air temperatures below 40°F (4.4°C). Wind chill cooling rate and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

4.5.4 An Equivalent Chill Temperature (ECT) chart relating the actual dry bulb air temperature and the wind velocity is presented in *S3AM-112-ATT1 Temperature Thresholds*. Unless unusual or extenuating circumstances exist, cold injury to other than hands, feet, and head is not likely to occur without the development of the initial signs of hypothermia. Superficial or deep local tissue freezing will occur only at temperatures below 32°F (0°C) regardless of wind speed. However, older employees, those with circulatory problems and those with previous cold injuries require special precautionary protection against cold injury. The use of extra insulating clothing and/or a reduction in the duration of the exposure period are among the special precautions that should be considered.

4.5.5 Continuous exposure of skin should not be permitted when the air speed and temperature results in an ECT of -25°F (-32°C) or below.

4.5.6 At air temperatures of 40°F (4.4°C) or less, it is imperative that employees who become immersed in water or whose clothing becomes wet be immediately removed from the cold environment, provided a change of clothing, and be treated for hypothermia.

4.5.7 If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

4.5.8 Adequate protection, such as general ventilation, shall be incorporated into any warming shelter design to prevent carbon monoxide poisoning.

- 4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.
- 4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.
- 4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.
- 4.5.12 Confirm that employees carry fire starter materials if working in remote areas.
- 4.5.13 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the SH&E Manager and/or the Manager and made available. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.
- 4.6 Cold Stress Prevention Measures for the Hands
 - 4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:
 - If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60°F (15°C), special provisions should be established for keeping the employees' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30°F (-1° C).
 - If the air temperature falls below 60°F (15°C) for sedentary work, 40°F (4.4° C) for light work, or 20°F (-6°C) for moderate work, and fine manual dexterity is not required, employees should use gloves.
 - 4.6.2 To prevent contact frostbite, employees should wear anti-contact gloves:
 - When cold surfaces below 20°F (-6°C) are within reach, each employee should be warned to prevent inadvertent contact by bare skin.
 - If the air temperature is 0°F (-18°C) or less, employees should protect their hands with mittens or appropriate gloves. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens or gloves.
 - Ensure an adequate supply of dry gloves is available to replace wet gloves.
 - 4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40°F (4.4°C). The employees should wear cold protective clothing appropriate for the level of cold and physical activity.
 - 4.6.4 Additional Cold Stress Prevention Measures:

For work practices at or below 10°F (-12°C) ECT, the following will apply:

 - The employee should be under constant protective observation (buddy system or supervision).
 - The work rate should not be so high as to cause heavy sweating that will result in wet clothing. If heavy work is being performed, rest periods should be taken in heated shelters and opportunities to change into dry clothing should be provided.
 - New employees should not be required to work full time in the cold during the first days of employment until they become acclimated to the working conditions and required protective clothing. Refer to *S3AM-112-ATT1 Temperature Thresholds* for guidance.
 - The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the employee.
 - The work should be arranged in such a way that sitting still or standing still for long periods is minimized. Unprotected metal chair seats should not be used. The employee should be protected from drafts to the greatest extent possible.

- 4.6.5 Employees handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of “cryogenic fluids” or those liquids with a boiling point that is just above ambient temperature.
- 4.6.6 Trauma sustained in freezing or subzero conditions requires special attention, because an injured employee is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

4.7 Hypothermia in Water

- 4.7.1 Loss of body heat to the water is a major cause of deaths in boating and working near water incidents. Often the cause of death is listed as drowning; however, the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around 2 to 3 degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE	EXHAUSTION	SURVIVAL TIME
32.5°F (0°C)	Under 15 minutes	Under 15 to 45 minutes
32.5 to 40°F (0 to 4°C)	15 to 30 minutes	30 to 90 minutes
40 to 50°F (4 to 10°C)	30 to 60 minutes	1 to 3 hours
50 to 60°F (10 to 16°C)	1 to 2 hours	1 to 6 hours
60 to 70°F (16 to 21°C)	2 to 7 hours	2 to 40 hours
70 to 80°F (21 to 27°C)	3 to 12 hours	3 hours to indefinite
Over 80°F (27°C)	Indefinite	Indefinite

- 4.7.2 Some points to remember when water is a potential hazard:

- Wear a personal flotation device when drowning is a potential hazard. Refer to *S3AM-315-PR1 Working On or Near Water*, and *S3AM-333-PR1 Marine Safety & Vessel Operations*.
- If the water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading, or if a significant potential to fall in water exists).
- While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep the head out of the water. This will increase survival time.
- Keep a positive attitude about rescue. This will increase chances of survival.
- If there is more than one person in the water, huddling is recommended to conserve body heat.

- 4.7.3 If an employee or equipment is to work on ice and the water beneath the ice is or may be more than 3¼ feet (1m) deep at any point:

- Test the ice prior to commencing to ensure it will support the load to be placed on it. Ongoing testing may be necessary.
- If there is any risk of falling through the ice employees must wear personal protective equipment that will ensure buoyancy and protect against hypothermia at all times while on the ice.

4.8 Work-Warming Regimen

- 4.8.1 If work is performed continuously in the cold at an equivalent chill temperature (ECT) at or below 19°F (−7°C), heated warming shelters (tents, cabins, rest rooms, etc.) should be made available nearby. The employees should be encouraged to use these shelters at regular intervals; the frequency will depend on the severity of the environmental exposure. Refer to *S3AM-112-ATT1 Temperature Thresholds* for guidance.

- 4.8.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.
- 4.8.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.
- 4.8.4 A change of dry work clothing should be provided as necessary to prevent employees from returning to the cold environment with wet clothing.

5.0 Records

- 5.1 Exposure assessments will be documented in the location's files.

6.0 Attachments

- 6.1 [S3AM-112-ATT1 Temperature Thresholds](#)
- 6.2 [S3AM-112-ATT2 Symptoms & Treatment](#)

Americas

Temperature Thresholds

S3NA-112-ATT1

1.0 Purpose and Scope

- 1.1 The following Tables 1 and 2 give apparent temperatures (wind chill or equivalent chill temperature [ECT]) for various combinations of wind and air temperature, as well as guidelines to the danger of skin exposure.

Table 1. Wind Chill Chart (C)

Actual Temp (°C)	Wind Speed in km/hour									
	8	16	24	32	40	48	56	64	72	80
	Ambient Temperature (°C)									
0	-2	-8	-11	-14	-16	-17	-18	-19	-19	-20
-5	-7	-14	-18	-21	-23	-25	-26	-27	-28	-28
-10	-12	-20	-25	-28	-31	-33	-34	-35	-36	-36
-15	-18	-26	-32	-35	-38	-40	-42	-43	-43	-44
-20	-23	-32	-38	-43	-46	-48	-50	-51	-52	-52
-25	-28	-38	-45	-50	-53	-56	-57	-59	-59	-60
-30	-33	-45	-52	-57	-61	-63	-65	-67	-67	-68
-35	-39	-51	-59	-64	-68	-71	-73	-75	-75	-76
-40	-44	-57	-65	-71	-75	-79	-81	-83	-83	-84
-45	-49	-63	-72	-78	-83	-86	-89	-90	-91	-92
-50	-54	-69	-79	-85	-90	-94	-96	-98	-99	-100

Note: A. Little Danger: if less than one hour of exposure to dry skin.

B. Danger: Exposed flesh freezes within one minute.

C. Great Danger: Flesh may freeze within 30 seconds.

Source: *2014 Threshold Limit Values (TLV™) and Biological Exposure Indices (BEI™) booklet; published by ACGIH, Cincinnati, Ohio.

Table 2. Equivalent Chill Temperature Chart (F)

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	Equivalent Chill Temperature (°F)									
Calm	50	40	30	20	10	0	-10	-20	-30	-20
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-24	-33	-46	-58	-70
15	36	22	9	-5	18	-32	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-75	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	35	-51	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Wind speeds >40 mph have little additional effect	LITTLE DANGER				INCREASING DANGER			GREAT DANGER		
	Trenchfoot and immersion foot may occur at any point on this chart.									

- 1.2 How fast a person's body cools in cold weather depends on: air temperature, wind speed, heat of the sun, and work being done.
- 1.2.1 The following Table 3 provides guidelines for establishing periods of work to warming break periods based on ambient temperature and wind speed for workers wearing dry clothing.
- 1.2.2 Notes following the Table take into account additional factor such as physical exertion, whether workers are acclimatized, etc.

Table 3. Work-Warming Schedule Guidelines

Air Temp. (Sunny Sky) °F	No Noticeable Wind		5 mph Wind (8 km/h)		10 mph Wind (16 km/h)		15 mph Wind (24 km/h)		20 mph Wind (32 km/h)		25 mph Wind (40 km/h)		Air Temp. (Sunny Sky) °C
	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	
above 5°	Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		above -15°
5° to -1°											100 min	2	-15° to -17°
0° to -4°									100 min	2	75 min	2	-18° to -20°
-5° to -9°							100 min	2	75 min	2	55 min	3	-21° to -22°
-10° to -14°					100 min	2	75 min	2	55 min	3	40 min	4	-23° to -25°
-15° to -19°					100 min	2	75 min	2	55 min	3	40 min	4	30 min
-20° to -24°	100 min	2	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work		-29° to -31°
-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work				-32° to -34°
-30° to -34°	55 min	3	40 min	4	30 min	5	Cease Work						-35° to -37°
-35° to -39°	40 min	4	30 min	5	Cease Work								-38° to -39°
-40° to -44°	30 min	5	Cease Work										-40° to -42°
-44° & below	Cease Work												Cease Work

Modified from ACGIH 2014 Threshold Limit Values for Chemical Substances and Physical Agents.

- Note 1: Schedule describes the maximum continuous duration of work and number of 10-15 minute breaks to be observed during any 4-hour work period and assumes that period will be followed by an extended warm-up period (e.g., lunch). Allowed breaks should be taken in a warm environment.
- Note 2: Schedule applies to moderate to heavy work performed by acclimated workers wearing appropriate layered clothing. For light to moderate work apply the schedule for conditions one step lower. For unacclimated workers apply the schedule for conditions two steps lower. These modifications are additive.
- Note 3: For work under 25%–50% overcast/clouds, apply the schedule for conditions one step lower. For work at night or under greater than 50% overcast/clouds, apply the schedule for conditions two steps lower. These modifications are additive with any applicable modifications from Note 2.

Note 4: For wind speeds in excess of 25 mph (40 km/h), cease all nonemergency work when temperatures fall below 5°F (-21°C).

Note 5: When the work involves riding on an unshielded vehicle or some other activity that generates wind, the number of breaks should be increases appropriately.

Note 6: If effective protection against the wind can be provided by shields or screens, work modifications or measures, then the work warm-up schedule for “No Noticeable Wind” would apply.

Note 7: If reliable weather reports are not available, use the following as a guide to estimate wind velocity:

- A 5 mph (8 km/h) wind will move a light flag
- A 10 mph (16 km/h) wind will fully extend the flag
- A 15 mph (24 km/h)wind will raise a newspaper sheet
- A 20 mph (23 km/h) wind will produce blowing and drifting snow.

Symptoms & Treatment

S3NA-112-ATT2

1.0 Cold Stress-related Illnesses

1.1 Frostbite

- 1.1.1 Frostbite is a localized cold injury characterized by freezing of the tissues with ice crystal formation. There are several degrees of damage. Frostbite can be categorized into:
- **Frost Nip or Initial Frostbite:** (1st degree frostbite) Characterized by blanching or whitening of skin.
 - **Superficial Frostbite:** (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.
 - **Deep Frostbite:** (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.
- 1.1.2 Frostbite injury is almost always limited to the upper and lower extremities (finger and toes) or to such appendages as the ears, nose or cheeks.
- 1.1.3 Conditions conducive to frostbite include sub-zero temperatures, hypothermia, dehydration, obstruction of the blood supply to the extremities (by constricting clothing, especially on the feet or at the wrists or ankles), contact with cold metal, contact with organic liquids (such as gasoline or solvents that have been left outdoors in sub-zero temperatures), use of substances that cause vasoconstriction (such as smoking tobacco), or other injury or shock.
- 1.1.4 Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues.
- 1.1.5 Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.
- 1.1.6 The first symptom of frostbite is an uncomfortable sensation of coldness and pain, followed by numbness. There may be tingling, stinging, or cramping. Ongoing symptoms of frostbite include:
- Sudden and complete cessation of cold or discomfort in affected fingers or toes, often followed by a pleasant feeling of warmth;
 - Subsequently the only symptom may be the absence of any sensation in the frozen part;
 - Paleness in the affected tissues;
 - Firm or hard tissues; and
 - Purple tissue, if a large area, such as an entire hand or foot, is frostbitten.
- 1.1.7 If exposure occurs in temperatures that are below freezing (32°F or below), frostbite or trench foot (immersion foot) may accompany or complicate the symptoms of hypothermia. Frostbite is the freezing of living tissues with a resultant breakdown of cell structure. Symptoms due to frostbite may include, but is not limited to:
- Superficial redness of the skin,
 - Slight numbness,
 - Blisters,
 - Obstruction of blood flow (ischemia),
 - Blood clots (thrombosis), and
 - Skin discoloration due to insufficient oxygen in the blood (cyanosis).

1.1.8 Frostbite may occur if the skin comes into contact with objects with a surface temperature below freezing, such as metal tool handles. Trench foot is caused by continuous exposure to cold combined with persistent dampness or immersion in water. Injuries in this case include permanent tissue damage due to oxygen deficiency, damage to capillary walls, severe pain, blistering, tissue death, and ulceration.

1.1.9 Additionally, cold exposures may either induce or intensify vascular abnormalities. These include chilblain (a swelling or sore), Raynaud's disease, acrocyanosis (blueness of hands and feet) and thromboangiitis (inflammation of the innermost walls of blood vessels with accompanying clot formation). Workers suffering from these ailments should take particular precautions to avoid chilling.

1.2 Hypothermia

1.2.1 Hypothermia is a lower than normal body temperature that occurs when outer cold cools the body faster than the body can produce heat to stay warm. When this situation first occurs, blood vessels in the skin constrict in an attempt to conserve vital internal heat. Hands and feet are the first affected.

- If the body continues to lose heat, involuntary shivers begin. This is the body's way of attempting to produce more heat, and it is usually the first real warning sign of hypothermia.
- Further heat loss produces speech difficulty, confusion, loss of manual dexterity, collapse, and finally death.

1.2.2 Hypothermia can be caused by exposure to wind, cold, and/or moisture. The combination of wind, cold, and moisture can be deadly. Wet clothes or immersion in cold water greatly increases the hypothermia risk. The progressive clinical presentation of hypothermia is described in the table below.

Condition	Core Body Temp.	Signs/Symptoms	Treatment
Mild Hypothermia	99 – 97 F 37 – 36 C	Normal, shivering may begin	Seek dry shelter; replace wet clothing, insulate whole body and head, avoid sweating, use external warmth (bath, fire) only if core above 95 degrees F, give warm sweet drinks and food.
	97 – 95 F 36 – 35 C	Cold sensation, goose bumps, unable to perform complex tasks with hands, shiver can be mild to severe, hands numb.	
Moderate Hypothermia	95 – 93 F 35 – 34 C	Intense shivering, muscle in-coordination becomes apparent, movements slow and labored, stumbling pace, mild confusion may appear alert.	Avoid exercise and external warmth, gently rest; give warm sweet drinks and calories, internal warming via warm moist air, monitor pulse and breathing.
	93 – 90 F 34 – 32 C	Violent shivering persist, difficulty speaking, sluggish thinking, amnesia starts to appear, gross muscle movements sluggish, unable to use hands, stumbles frequently, signs of depression, withdrawn.	
Severe Hypothermia	90 – 86 F 32 – 30 C	Shivering stops, exposed skin blue or puffy, muscle coordination very poor, inability to walk, confusion, incoherent/irrational behavior, but may be able to maintain posture and appearance of awareness.	Medical emergency, give nothing by mouth, wrap in an insulated blanket, avoid rapid rewarming, transfer to hospital immediately.
	86 – 82 F 30 – 28 C	Muscle rigidity, semiconscious, stupor, loss of awareness of others, pulse and respiration rate decrease, possible heart fibrillation.	
	82 – 78 F 28 – 25.5 C	Unconscious, heart beat and respiration erratic, pulse may not be palpable.	
	78 – 75 F 25.5 – 24 C	Pulmonary edema, cardiac and respiratory failure, death. Death may occur before this temperature is reached.	

- 1.2.3 Early warning signs of hypothermia:
 - Feeling of being cold and tired,
 - Heavier breathing and increased pulse rate,
 - Tendency to keep moving (e.g., stamping feet, rubbing hands, continued walking/pacing),
 - Goose bumps, holding arms tightly wrapped around the body, hunching of shoulders, and
 - Shivering.
- 1.2.4 Hypothermia damages both the body's internal temperature mechanisms (hypothalamus) and the peripheral mechanisms to prevent heat loss (vasoconstriction and perspiration.) These effects may last up to three years after the initial hypothermia episode. Symptoms of hypothermia may include, but are not limited to:
 - Pain in the extremities,
 - Severe shivering and numbness,
 - Low core body temperature,
 - Drowsiness and muscular weakness,
 - Apathy,
 - Mental confusion,
 - Loss of consciousness,
 - Shock, and
 - Decreasing pulse and breathing rate.

2.0 Recommended Treatment for Cold Stress-related Illnesses

- 2.1 Frostbite
 - 2.1.1 Wrap the victim in woollen blanket and keep dry until he or she can be brought inside.
 - 2.1.2 Remove the victim from the cold environment.
 - 2.1.3 Do not rub, chafe, or manipulate frozen parts.
 - 2.1.4 Place the victim in warm water (102°F to 105°F) and make sure the water remains warm. Test the water by pouring it on the inner surface of your forearm. Never thaw affected body parts if the victim has to go back out into the cold; refreezing can cause significant tissue damage.
 - 2.1.5 Do not use hot water bottles or a heat lamp, and do not place the victim near a hot stove.
 - 2.1.6 Do not allow the victim to walk if his or her feet are affected.
 - 2.1.7 Have the victim gently exercise the affected parts once they are thawed.
 - 2.1.8 Seek immediate medical attention for thawing of serious frostbite.
- 2.2 Hypothermia
 - 2.2.1 Bring the victim into a warm room or shelter as quickly as possible.
 - 2.2.2 Give artificial respiration and stop any bleeding, if necessary.
 - 2.2.3 If the victim cannot be moved (spinal injury, etc.), carefully place newspapers, blankets, or some other insulation between the victim and the ground.
 - 2.2.4 Remove all wet clothing.
 - 2.2.5 Provide an external heat source, because the body cannot generate its own heat. Wrap the victim in prewarmed blankets, place him or her in the liner of a portable hypothermia treatment unit, put the torso (not the extremities) into a tub of warm water, or use body-to-body contact to rewarm the body core. These measures will slowly reopen the peripheral circulation, minimizing the possibility

of after-shock or after-drop (the flowing of cooled, stagnated blood from the limbs to the heart), which may cause ventricular fibrillation, cardiac arrest, or death.

- 2.2.6 Do not allow the victim to sleep.
- 2.2.7 Give warm, sweet drinks. Do not give alcohol or pain relievers.
- 2.2.8 Keep the victim still. Do not try to walk.
- 2.2.9 Do not rub numb skin.
- 2.2.10 Get medical attention as soon as possible.

Heat Stress

S3AM-113-PR1

1.0 Purpose and Scope

- 1.1 Establishes a Heat Illness Prevention Program to guide employees in preventing heat illness, recognition of the symptoms of heat stress-related illnesses and in taking the appropriate corrective action.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Acclimated** – Employees who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.
- 2.2 **Chemical Protective Clothing (CPC)** – Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the Employee with potentially hazardous materials in the workplace. Such materials include Tyvek® coveralls (all types) and polyvinyl chloride coveralls and rain suits.
- 2.3 **Heat Cramps** – A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.
- 2.4 **Heat Exhaustion** – A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.
- 2.5 **Heat Rash** – A heat-induced condition characterized by a red, bumpy rash with severe itching.
- 2.6 **Heat Stress** – The combination of environmental and physical work factors that constitute the total heat load imposed on the body.
- 2.7 **Heat Stroke** – The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.
- 2.8 **Sunburn** – Caused by unprotected exposure to ultraviolet radiation present in sunlight that is damaging to the skin (Refer to *S3AM-121-PR1 Non-Ionizing Radiation*). The injury is characterized by red painful skin, blisters, and/or peeling.
- 2.9 **Unacclimated** – Employees who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation
- 3.3 S3AM-010-PR1 Emergency Response Planning
- 3.4 S3AM-121-PR1 Non-Ionizing Radiation
- 3.5 S3AM-208-PR1 Personal Protective Equipment
- 3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 Managers

- Evaluate the need for heat illness prevention measures and incorporate as appropriate into the Safe Work Plan or Task Hazard Analysis.
- Allocate sufficient resources for the management of heat illness in the field including the provision of water, a shaded break area, and sufficient schedule to allow for breaks.

4.1.2 Safety, Health and Environment (SH&E) Manager

- Provide heat illness awareness training.
- Assist in developing appropriate work-rest schedules.
- Conduct/support incident investigations related to potential heat stress-related illnesses.

4.1.3 Supervisor

- Identify those tasks that may be most impacted by heat stress and communicate the hazard to the assigned Employees.
- Confirm that Employees have been trained on the recognition of heat illness.
- Confirm that this procedure, along with any applicable Safe Work Plan and/or Task Hazard Analysis (and heat exposure control plan that may be contained therein) are made available to affected Employees.
- Confirm that adequate supplies of appropriate fluids are readily available to Employees.
- Confirm that a proper rest area is available.
- Conduct heat illness monitoring, as applicable.
- Implement the work-rest schedule.
- Confirm that first aid measures are implemented once heat stress symptoms are identified.
- Confirm personnel are physically capable of performing the assigned tasks and are not in a physically compromised condition.
- Report all suspected heat illnesses.

4.1.4 Employee

- Observe each other for the early symptoms of heat illnesses.
- Maintain an adequate intake of available fluids.
- Be familiar with heat stress hazards, predisposing factors, and preventative measures.
- Report to work in a properly vested and hydrated condition.
- Report all suspected heat stress-related illnesses.

4.2 Restrictions

- 4.2.1 The Buddy System is required when working in high heat conditions; Employees shall not work alone.
- 4.2.2 Employees shall not be exposed to levels exceeding those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.
- 4.2.3 Clothing corrections shall be applied in accordance with the tables provided in *S3AM-113-ATT1 Temperature Thresholds*.

4.3 Exposure Controls

4.3.1 It shall be determined whether Employees are or may be exposed to hazardous heat levels. The Supervisor shall:

- Conduct a heat stress assessment to determine the potential for hazardous exposure of Employees. Assessment shall include, but not limited to:
 - Ambient temperature.
 - Amount of sunshine (cloudy, clear). Refer to *S3AM-121-PR1 Non-Ionizing Radiation* additional direction concerning ultraviolet radiation exposures.
 - Other radiant heat sources (e.g. motor, fire, etc.).
 - Humidity.
 - Air flow.
 - Amount or type of physical labor being performed,
 - Physical condition of the Employees (e.g., acclimated/not)
 - Protective clothing in use.
 - Referral to *S3AM-113-ATT1 Temperature Thresholds* to assist in determining whether hazardous heat exposures may exist.
- If potential for hazardous exposure is identified, the Supervisor shall develop and implement a heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis. Refer to *S3AM-209-PR1 Risk Assessment & Management*.

4.3.2 If Employees are or may be exposed, the Supervisor shall implement engineering controls (e.g., shelters, cooling devices, etc.) to reduce the exposure of Employees to levels below those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Temperature Thresholds*.

4.3.3 If engineering controls are not practicable, the Supervisor shall reduce the exposure of Employees to levels below those listed in *S3AM-113-ATT1 Temperature Thresholds* by providing administrative controls, including a work-rest cycle or personal protective equipment, if the equipment provides protection equally effective as administrative controls.

4.3.4 If Employees are or may be exposed, the Supervisor shall provide and maintain an adequate supply of cool, fresh, potable water close to the work area for the use of a heat exposed Employee. Water shall be provided (paid) by the project or program; if Employees purchase their own drinking water because water is not otherwise available on site, they shall be reimbursed.

4.3.5 If an Employee shows signs or reports symptoms of heat stress or strain, they shall be removed from the hot environment and treated by an appropriate first aid attendant on site, if available, or by a physician, refer to *S3AM-113-ATT2 Symptoms & Treatment* for more specifics.

4.4 Heat Stress Planning

4.4.1 Heat stress can be a significant site hazard, especially for Employees wearing CPC. To prepare for emergency response planning, refer to *S3AM-010-PR1 Emergency Response Planning* procedure.

4.4.2 The project and site specific risks need to be planned using the SH&E Plan and the Task Hazard Assessments (THA). Refer to the *S3AM-209-PR1 Risk Assessment & Management* procedure.

4.4.3 The heat a worker is exposed to may be a combination of air temperature, radiant heat, and humidity. The WBGT (wet-bulb globe thermometer) is a useful index of the environmental contribution to heat stress. Because WBGT is only an index of the environment, the contributions of

work demands, clothing, and state of acclimatization shall also be accounted for, as described in the following steps.

- Monitor ambient temperatures and conduct heat stress monitoring in accordance with the location specific SH&E Plan. Revise the heat stress monitoring and controls if there are any reports of discomfort due to heat stress.
- Monitor temperatures in each unique environment in which workers perform work (e.g., take WBGT measurements inside truck cabs for truck drivers, and take separate WBGT measurements in the outdoor area where field employees work, etc.). Follow manufacturer's instructions on proper use of the WBGT.
- Determine if individual workers are acclimatized or un-acclimatized. Full heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, or when there is a sustained increase in temperatures of 10 °F (5.6 °C) or more, and a noticeable loss occurs after 4 days. A worker can be considered acclimatized for the purpose of this procedure when they have been exposed to the site conditions (including level of activity) for 5 of the last 7 days.
- Determine the approximate workload of each worker or group of workers. The following examples (Table 1) can be used for comparison:

Table 1
Examples of Activities within Workload Categories

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on level at 3.5 miles/hr (6 km/hr) while carrying 6.6 lbs (3kg) weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a non-continuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

- Determine the approximate proportion of work within an hour during a typical shift. Typically, the initial work schedule will be 60 minutes of work per hour (100 percent work) with a small break in the morning and afternoon, as appropriate, and a 30-minute lunch break mid-day.
- For workers wearing cloth coveralls (e.g., Nomex fire resistant clothing), add 3 to the measured WBGT. For impermeable clothing, such as Tyvek or Saranex, the WBGT procedures cannot be used. For these situations, workers should begin physiological monitoring as soon as the temperature in the work area exceeds 70°F (21°C).
- Use the collected information to develop appropriate work to rest schedules as detailed in *S3AM-113-ATT1 Temperature Threshold*.

4.4.4 Given the work demands (light, moderate, heavy or very heavy), heat of the work environment, and such aspects as PPE in use, workload will be adjusted appropriately to allow for proper acclimation.

- This is the process by which the body "gets used to" hot work environments. This is achieved by slowly increasing workloads.
 - New and returning Employees (absent one week or more) who have not had time to acclimatize may be more susceptible to heat related illnesses, even in seemingly low risk heat exposures.
 - All Employees shall be allowed time to acclimatize in the event of a heat wave. All Employees assigned to a new process with additional heat exposures shall be allowed to acclimatize.
 - Minimize workload and gradually increase as tolerance is built up. Allow for more frequent breaks.
 - While acclimatization normally takes approximately 5 to 7 days, heightened monitoring of these Employees will be maintained for the first 14 days.
- 4.4.5 Employees shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Employees shall be encouraged to immediately report any heat stress that they may experience or observe in fellow Employees. Supervisors shall use such information to adjust the work-rest schedule to accommodate such problems.
- 4.4.6 Wherever possible, a designated break area should be established in an air conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow Employees to loosen or remove protective clothing, and sufficient seating should be available for all Employees. During breaks, Employees shall be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.
- 4.5 Symptoms and Treatment
- 4.5.1 Refer to *S3AM-113-ATT2 Symptoms & Treatment*.
- 4.5.2 Employees who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin) shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.
- 4.5.3 Anyone exhibiting symptoms of heat stroke (red dry skin, or unconsciousness) shall be taken immediately to the nearest medical facility. Steps shall be taken to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).
- 4.5.4 Severe heat stress (heat stroke) is a life-threatening condition that shall be treated by a competent medical authority.
- 4.6 Prevention
- 4.6.1 Requirements for working in extreme heat may be triggered by a regulatory established criteria (e.g. CAL/OSHA requires high heat procedures when temperature equals or exceeds 95°F) or as a result of a hazard analysis assessing various contributory factors (refer to *S3AM-113-ATT1 Temperature Thresholds*). Employees working in extreme heat or sun should understand and apply the following guidelines for preventing and detecting heat exhaustion and heat stroke.
- When possible, begin hydrating at least three days prior to working in high heat conditions.
 - Review the heat stress exposure control plan within the Safe Work Plan and/or Task Hazard Analysis.
 - If the supervisor is not immediately available confirm a reliable method of communication is in place to allow for contact with supervision. In the absence of cellular reception a satellite phone or similar device may be required.

- Take frequent short breaks in areas sheltered from direct sunlight; eat and drink small amounts frequently.
- Try to schedule work for the coolest part of the day, early morning and evening.
- Avoid strenuous physical activity outdoors during the hottest part of the day.
- Avoid sudden changes of temperature. Refer to *S3AM-113-ATT1 Temperature Thresholds*.
- Air out a hot vehicle before getting into it.
- Obtain medical direction if taking diuretics during hot weather (a lower dose may be necessary).
- When working in heat, drink 1 quart of water per hour of work.
- Avoid caffeine and alcohol as they increase dehydration.
- Monitor urine frequency and color to detect dehydration. Refer to the *S3AM-113-ATT3 Dehydration Chart*.
- The Buddy System is required when working in high heat conditions to enable effective communication and cross-observation for indications of heat stress.
- Initiate emergency response procedures when necessary, including contacting emergency medical services as appropriate and in accordance with the Emergency Response Plan.

4.6.2 Personal Protective Equipment

- Review the *S3AM-208-PR1 Personal Protective Equipment* procedure.
- Wear a hat and light-colored, loose-fitting clothing to reflect the sun.
- Apply sunscreen to exposed skin (SPF 30 or greater, follow directions on label).
- Wear sunglasses with UV protection.
- Pack extra water to avoid dehydration (try freezing water in bottles overnight to help keep the water cooler for longer during the day).

4.7 Work-Rest Schedule Practices

- 4.7.1 Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 ounces (1 quart) per hour during the work shift; fluid replacement at frequent intervals is most effective.
 - The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
 - If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.
- 4.7.2 Additional salt is usually not needed and salt tablets should not be taken.
- 4.7.3 Replacement fluids should be cool and fresh, but not cold.
- 4.7.4 Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.
- A relatively cool, shaded area shall be provided for breaks when working in hot environments. For hazardous waste sites, the rest area should be located in the support zone adjacent to the contamination reduction zone, situated so that part of it is in the decontamination area so workers can take breaks without going through full decontamination.

- If shade is not available, shaded areas shall be constructed. This same type of canopy can be set up to shade personnel performing various types of work in hot weather.
- Cooling measures other than shade (e.g., misting, air conditioned break areas, air conditioned vehicles, etc.) can be used in lieu of shade provided it can be demonstrated that they are at least as effective in cooling employees.
- Employees should have access to these rest areas at break times and at any other time when suffering from heat illness or believing a preventive recovery period is needed.

4.7.5 Dry clothing or towels will be available to minimize chills when taking breaks.

4.7.6 Manual labor will not be performed during breaks, other than paperwork or similar light tasks.

4.7.7 Other controls that may be used include:

- Scheduling work at night or during the cooler parts of the day (6 am–10 am, 3 pm–7 pm).
- Erecting a cover or partition to shade the work area.
- Auxiliary cooling - wearing cooling devices beneath protective garments, but over any underclothing.
 - If cooling devices are worn, only physiological monitoring will be used to determine work activity.
 - These vests typically provide cooling via one of two methods: the use of ice or other frozen media, or the use of a vortex cooler. Each method has its advantages and disadvantages.
 - The frozen media vest requires a means for freezing the media, and the media (usually water or "blue ice") will melt, requiring replacement.
 - The vortex cooler tends to cool more uniformly. Instead of frozen media, this vest uses the expansion of compressed air to cool the wearer. The drawback is the compressed air requirement, but this is negated when the wearer is already using an airline respirator supplied by a compressor. A vortex cooler should not be supplied from air cylinders, as this will draw down the cylinders rapidly.
- Auxiliary cooling should be considered when the following conditions exist:
 - Ambient temperature over 80°F (26°C).
 - Workers are wearing impermeable garments (i.e., Tyvek, Saranex, Chemrel, etc.).
 - It is desirable to have long work shifts with minimum interruption.

4.8 Evaluating the Work-Rest Schedule's Effectiveness

4.8.1 Once a work-rest schedule is established, the Supervisor shall continually evaluate its effectiveness through observation of Employees for signs/symptoms of heat stress. Have workers assess themselves and their body's reaction to the heat and work conditions (self-assessment), and report any signs or symptoms of heat illness. These can include nausea or dizziness, heat cramps, extreme thirst, or very dark urine.

4.8.2 Measurement or physiological monitoring of each Employee's vitals (e.g., pulse, blood pressure, and temperature) can provide additional information in determining if the schedule is adequate. Refer to *S3AM-113-ATT1 Temperature Thresholds* for additional guidance on when physiological monitoring should be conducted.

4.8.3 Frequency of physiological monitoring is increased or decreased depending upon such factors as worker fitness, acclimatization, temperature of the work environment, type of PPE, etc.

Based on the results of the physiological monitoring and on the workers' self-assessments, the work period may be adjusted as follows:

- The work period may be increased (generally, by 5- to 10-minutes intervals, up to a maximum of 4 hours) if the results of the first 2 hours of the physiological monitoring and the workers' self-assessments indicate that workers are recovering adequately (see below), and on the judgment of the SH&E Manager.
 - The work period shall be decreased if the results of the physiological monitoring and the workers' self-assessment indicate that workers are NOT recovering adequately (see below).
- 4.8.4 If physiological monitoring is conducted, the Employee and/or the SH&E Manager (or appropriate designate) shall measure and record body temperature and pulse rate as described below.
- 4.8.5 Monitor body temperature to determine if Employees are adequately dissipating heat build-up. Ear probe thermometers which are adjusted to oral temperature (aural temperature) are convenient and the preferred method of measurement. Determine work/rest regimen as follows:
- Measure oral body temperature at the end of the work period. Oral body temperatures are to be obtained prior to the employee drinking water or other fluids.
 - If temperature exceeds 99.6°F (37.5°C), shorten the following work period by 1/3 without changing the rest period.
 - If, at the next rest period, temperature still exceeds 99.6°F (37.5°C), the worker should not be allowed to continue work until repeated temperature measurements are in the acceptable range (i.e., less than 99.6°F). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.
 - Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6°F (38.1°C).
- 4.8.6 At the start of the workday each Employee's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four or by using an automated pulse count device. Pulse rates can then be measured at the beginning of each break period and two minutes thereafter to determine if the rest period allows for adequate recovery.
- Take the radial (wrist) pulse as early as possible in the rest period and determine the worker's heart rate in beats per minute. The heart rate is determined by counting the pulse for ten seconds and multiplying the number by 6 to get the beats per minute. Record this as P1.
 - Wait 2 minutes and repeat the pulse measurement. Record this as P2.
 - If P1 is greater than or equal to 110 beats per minute (bpm) and if (P1 – P2) is less than or equal to 10 bpm (indicating that workers are not recovering adequately), shorten the next work cycle by 1/3 without changing the rest period.
 - At the next rest period, if P1 is still equal to or greater than 110 bpm, and if (P1 – P2) is still less than or equal to 10 bpm, shorten the following work cycle by 1/3 without changing the rest period.
 - At the third rest period, if P1 is still equal to or greater than 110 bpm and (P1 – P2) is still less than or equal to 10 bpm, the worker should not be allowed to continue work until repeated pulse measurements are in the acceptable range (i.e., P1 is less than 110 bpm and (P1 – P2) is greater than 10 bpm). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.
- 4.8.7 Use of an automated or similar blood pressure device will be used to assess each Employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:
- If the blood pressure of an Employee is outside of 90/60 to 150/90, then the Employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be re-measured and the end-of-break criteria again applied.

- 4.8.8 All physiological monitoring of heat stress will be documented using *S3AM-113-FM1 Heat Stress Monitoring Log*.

4.9 Training

- 4.9.1 Employees and their Supervisors that may be exposed to the hazard will be trained and oriented to the hazard and the controls prior to work commencing.
- 4.9.2 Those Employees, including Supervisors, potentially exposed to heat stress will receive training, refer to the *S3AM-003-PR1 SH&E Training* procedure. Training will include, but is not limited to:
- Sources of heat stress (environmental and personal), influence of protective clothing, and importance of acclimatization;
 - How the body handles heat and acclimatization;
 - Recognition of heat-related illness symptoms;
 - Preventative/corrective measures including, but not limited to;
 - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
 - All Employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
 - First aid procedures for heat stress-related illnesses; and
 - Immediate reporting of any heat-related incident (injury, illness, near-miss), refer to the *S3AM-004-PR1 Incident Reporting, Notifications & Investigation* procedure.

5.0 Records

- 5.1 None

6.0 Attachments

- 6.1 [S3AM-113-ATT1 Temperature Thresholds](#)
- 6.2 [S3AM-113-ATT2 Symptoms & Treatment](#)
- 6.3 [S3AM-113-ATT3 Dehydration Chart](#)
- 6.4 [S3AM-113-FM1 Heat Stress Monitoring Log](#)

Americas

Heat Stress Monitoring Log

S3NA-113-FM1

The purpose of this form is to monitor employees for heat illness when applicable. It is the responsibility of the Foreman or Supervisor-in-Charge to ensure that each person completes the required information.

Project Name:			Foreman/Supervisor:						Work/Rest Schedule¹: IN (min) OUT (min)							
Date:	Water Provided¹		Acclimated²		Initial Vitals³	Vital Signs and Time In/Out³			Celcius <input type="checkbox"/> / Farenheit <input type="checkbox"/> (select one)							
Employee Name	Yes	No	Yes	No	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)
					P			P			P			P		
					BP			BP			BP			BP		
					Temp			Temp			Temp			Temp		
					P			P			P			P		
					BP			BP			BP			BP		
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					Temp			Temp			Temp			Temp		

- Each Employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
- An Employee is "acclimated" if he/she has worked in a hot environment for at least 5 - 7 consecutive days. If an Employee is acclimated, check "Yes." If an Employee is not acclimated, check "No" and reduce the "Min In" by 50 percent for that Employee until the 5 - 7 -day period is reached.
- "Vitals" refers to Employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work and at each break period, or as specified in the Heat Stress Exposure Control Plan.

Heat Stress Monitoring Log (S3NA-113-FM1)

Revision 0 March 1, 2016

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Temperature Thresholds

S3NA-113-ATT1

1.0 Work-Rest Schedule

The prevention of heat stress is best performed through Supervisor observation of Employees and routine heat stress awareness training activities. However, it is also necessary to implement a work routine that incorporates adequate rest periods to allow Employees to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover. The frequency and length of work breaks shall be determined by the Supervisor based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition of the Employees (e.g., acclimated/not), and protective clothing being used.

1.1 Establishing a Work-Rest Schedule:

1.1.1 AECOM permits the use of either of two techniques to initially determine an appropriate daily work-rest schedule. These methods are:

- Wet Bulb Globe Thermometer (WBGT) Method: This method is preferred if a WBGT meter is available.
- Adjusted Temperature Method: This method should be used only if WBGT data is not available.

1.1.2 Either procedure will provide the Supervisor with a recommended routine; however, adjustments to this routine may be required to accommodate the specific daily conditions at the work site.

1.2 WBGT Work-Rest Schedule Guidelines:

1.2.1 If the measured WBGT is less than the action limit value, there is little risk of excessive exposure to heat stress, and work can continue.

- Continue to monitor ambient conditions with the WBGT. However, if there are reports of the symptoms of heat-related disorders, then the analysis of little risk should be reconsidered.
- If the measured WBGT is greater than the values in the following two tables, institute heat stress controls, including the associated work-rest cycle, and perform physiological monitoring as described in *S3NA-113-PR1 Heat Stress*.
- Because of the physiological strain associated with very heavy work among less fit workers regardless of WBGT, values are not provided in Table 1 or 2 for continuous work or 75% work – 25% rest regimen. Physiological monitoring should always be implemented under these conditions.

1.2.2 Table 1, the Non-CPC Activities WBGT Chart, is intended for use where personnel are not utilizing Chemical Protective Clothing (CPC). Where workers are required to utilize CPC, Table 2, the CPC Activities WBGT Chart, will be used.

1.2.3 WBGT readings are compared directly with the values of the applicable WBGT Chart for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 1. Non-CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	85°F (29.4°C)	81°F (27.2°C)	78°F (25.6°C)	
75% Work – 25% Rest	86°F (30°C)	83°F (28.3°C)	81°F (27.2°C)	
50% Work – 50% Rest	88°F (31.1°C)	85°F (29.4°C)	83°F (28.3°C)	81°F (27.2°C)
25% Work – 75% Rest	90°F (32.2°C)	87°F (30.6°C)	86°F (30°C)	85°F (29.4°C)

Modified from ACGIH's 2014 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers.

Table 2. CPC Activities WBGT Chart

Work-Rest Regimen	WBGT			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
Continuous Work	74°F (23.3°C)	70°F (21.1°C)	67°F (19.4°C)	
75% Work – 25% Rest	75°F (23.9°C)	72°F (22.2°C)	70°F (21.1°C)	
50% Work – 50% Rest	77°F (25°C)	74°F (23.3°C)	72°F (22.2°C)	70°F (21.1°C)
25% Work – 75% Rest	79°F (26.1°C)	76°F (24.4°C)	75°F (23.9°C)	74°F (23.3°C)

Modified from ACGIH's 2014 *Threshold Limit Values for Chemical Substances and Physical Agents*, for acclimatized workers.

1.3 Humidex Based Work-Rest Schedule Guidelines

1.3.1 The Humidex method is a simplified way of protecting workers from heat stress. It is an equivalent scale intended to express the combined effects of warm temperatures and humidity. Humidex is used as a measure of perceived heat that results from the combined effect of excessive humidity and high temperature.

1.3.2 This method requires only a local air temperature and relative humidity value. Monitoring shall continue throughout the day for changing conditions. Identify a representative location where measurements can be taken. Measurements should be recorded at least hourly when ambient temperatures and 90°F (32°C) for personnel wearing normal permeable work clothes.

- **Step 1:** On the Humidex table below, look up the temperature on the left (Celsius is located below RH>) and the relative humidity (RH) on the top. Determine the Humidex value.

F	RH>	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%
108	42													55	52	50	48	46
106	41												55	53	51	48	46	44
104	40											55	53	51	49	47	45	43
102	39										55	53	51	49	47	45	43	41
100	38	Step 1 - Determine HUMIDEX VALUE								54	53	51	49	47	45	43	42	40
99	37								54	52	51	49	47	45	44	42	40	38
97	36					57	55	53	52	50	49	47	45	44	42	40	39	37
95	35				56	54	53	51	50	48	47	45	43	42	40	39	37	36
93	34		56	55	53	52	51	49	48	46	45	43	42	40	39	37	36	34
91	33	55	54	53	51	50	48	47	46	44	43	41	40	39	37	36	34	33
90	32	53	51	50	49	48	46	45	44	42	41	40	38	37	36	34	33	32
88	31	50	49	48	47	45	44	43	42	40	39	38	37	35	34	33	32	30
86	30	48	47	46	44	43	42	41	40	39	37	36	35	34	33	31	30	29
84	29	46	45	43	42	41	40	39	38	37	36	35	33	32	31	30	29	28
82	28	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27
81	27	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25
79	26	39	38	37	36	35	34	33	33	32	31	30	29	28	27	26	25	24
77	25	37	36	35	34	33	33	32	31	30	29	28	27	26	26	25	24	23

- Step 2: Place the Humidex value into the Heat Index Adjustment Table below. Determine the applicable adjustments based on the given work or task.

Heat Index Adjustment Table

Step 2 - Risk Factor Adjustment		
Write in value	What is the HUMIDEX value from the table in Step 1?	
Radiant Heat		Adjustment
	Working in full-sun	Add 2
	Working in ½ or partial sun or weak radiant heat source	Add 1
	Working near very hot equipment surfaces or processes	Add 2
Clothing: Pick One Only		
	Short/long sleeve shirt and pants – no overalls	None
	Overalls (e.g., Nomex suit)	Add 3
	Double layer overalls	Add 5
Stop	Impermeable clothing	Perform Physiological Monitoring
Acclimatization		
	Have been working at least 5 of last 7 days in heat stress conditions.	Subtract 4
Work Load & Miscellaneous Factors		
	Light Work (Standing, slow walking)	Subtract 2
	Medium Work (Walking about with moderate lifting or pushing)	None
	Heavy Work (Shoveling dry sand, carrying 50 lbs)	Add 2
	Very Heavy Work (Shoveling wet sand)	Add 3
TOTAL – Compare to Heat Index Response Plan		

- Step 3: Compare adjusted Heat Index Total to the Heat Index Response Plan table to obtain guidance for work/rest.

Heat Index Response Plan*

TOTAL NUMBER	Final Step 3 - HEAT INDEX Response
30-33	alert & information & water
34-37	warning & increase water
38-39	75% work - 25% rest & monitor for signs of heat stress
40-41	50% work - 50% rest & monitor for signs of heat stress
42-44	25% work - 75% rest & monitor for signs of heat stress
45+	Perform Physiological Monitoring

* Percent work and rest/recovery are on a per hour basis. Adjustments and subsequent work/rest cycle recommendations are rough guidelines only. No heat stress prediction scheme can replace monitoring of symptoms or a health care practitioners advice in the case of individuals with special medical conditions or predisposing circumstances for heat related illness. Always pay attention to the way workers are feeling. Recuperate if fatigued, nauseated, dizzy or thirsty,

1.4 Adjusted Temperature Work-Rest Schedule Guidelines:

This method can be utilized where WBGT data is not available, and requires only that the ambient temperature be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate humidity and a fully acclimated work force). The adjustments will be made by addition or subtraction to the ambient temperature reading, or changes in table position, as indicated in Table 3. Adjustments are independent and cumulative, all applicable adjustments should be applied. The result is the Adjusted Temperature, which can be compared with the values in Table 4 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest schedule.

Table 3. Temperature Adjustment Factors

Time of Day	
Before daily temperature peak ¹	+2°F (+1.11°C)
10 am – 2 pm (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind (<i>ignore if indoors or wearing CPC</i>)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity (<i>ignore if wearing CPC</i>)	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative Humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator)	+5°F (+2.78°C)
Level C (coveralls w/o hood, full-face respirator)	+8°F (+4.45°C)
Level C (coveralls with hood, full-face respirator)	+10°F (+5°C)
Level B with airline system (hooded chemical resistant clothing)	+9°F (+5.56°C)
Level B with SCBA (hooded chemical resistant clothing)	+9°F (+5.56°C) and right one column ²
Level A (totally encapsulating chemical protective suit)	+14°F (+7.78°C) and right one column
Other	Specified in the HASP
Miscellaneous	
Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

**For complete descriptions of Level A through D Protective Clothing refer to
Unites States 29 CFR 1910.120 Appendix B**

¹ This adjustment accounts for temperature rise during the day. If the temperature has already reached its daytime peak it can be ignored.

² Locate the proper column based on work rate, then move one column to the right (next higher work rate) before locating the corresponding adjusted temperature.

Table 4. Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Regimen	Adjusted Temperature			
	Light Work	Moderate Work	Heavy Work	Very Heavy Work
No specified requirements	< 80°F (22.67°C)	< 75 (23.88°C)	< 70 (21.11°C)	< 65 (18.33°C)
15 minute break every 90 minutes of work	80°F – 90°F (22.67°C) - (32.22°C)	75 – 85 (23.88°C) - (29.44°C)	70 – 80 (21.11°C) - (22.67°C)	65 – 75 (37.77°C) - (23.88°C)
15 minute break every 60 minutes of work	>90 – 100 (32.22°C) - (37.77°C)	> 85 – 95 (23.88°C) - (35°C)	>80 – 85 (22.67°C) - (23.88°C)	>75 – 80 (23.88°C) - (22.67°C)
15 minute break every 45 minutes of work	>100 – 110 (37.77°C) - (43.33°C)	>95 – 100 (35°C) - (37.77°C)	>85 – 90 (23.88°C) - (32.22°C)	>80 – 85 (22.67°C) - (23.88°C)
15 minute break every 30 minutes of work	>110 – 115 (43.33°C) - (46.11°C)	>100 – 105 (37.77°C) - (40.55°C)	>90 – 95 (32.22°C) - (35°C)	>85 – 90 (23.88°C) - (32.22°C)
15 minute break every 15 minutes of work	>115 – 120 (46.11°C) - (48.88°C)	>105 – 110 (40.55°C) - (43.33°C)	>95 -100 (35°C) - (37.77°C)	>90 – 95 (32.22°C) - (35°C)
Stop Work	>120 (48.88°C)	>110 (43.33°C)	>100 (37.77°C)	>95 (35°C)

Note: Time spent performing decontamination or donning/doffing CPC should not be included in calculating work or break time lengths.

Symptoms & Treatment

1.0 Heat Illness Symptoms

1.1 The following are four stages of heat-related illness:

1.1.1 Heat Rash

Heat rash (prickly heat) may result from continuous exposure to heat or humid air. It appears as red papules (elevated skin lesion), usually in areas where the clothing is restrictive, and gives rise to a prickly sensation, particularly as sweating increases. It occurs in skin that is persistently wetted by un-evaporated sweat. The papules may become infected unless treated.

1.1.2 Heat Cramps

Heat cramps are painful muscle cramps caused by heavy sweating and inadequate electrolyte replacement due to over-exertion in extreme heat. Symptoms include:

- Muscle spasms; and
- Pain in the hands, feet, and abdomen.

1.1.3 Heat Exhaustion

Heat exhaustion is the next stage. Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Symptoms include:

- Cool, moist, pale, flushed or red skin;
- Heavy sweating;
- Headache;
- Nausea or vomiting;
- Dizziness ;
- Exhaustion;
- Mood changes (irritable, or confused/can't think straight); and
- Fainting

The key here is that the victim is still sweating, so the cooling system is still working; it's just under severe stress. The body core temperature may be elevated, but not higher than 104°F (40°C). It is important to recognize and treat these symptoms as soon as possible, as the transition from heat exhaustion to the very hazardous heat stroke can be quite rapid.

1.1.4 Heat Stroke

Heat exhaustion can sometimes lead to heat stroke, the most serious form of heat stress, which can be fatal and requires emergency treatment. Heat stroke happens when body temperature regulation fails and body temperature continues to rise to critical levels, often to 105 degrees Fahrenheit (°F) (40.5 degrees Celsius [° C]) or higher. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Symptoms of heat stroke:

- Vomiting;
- Decreased alertness level or complete loss of consciousness;
- High body temperature (sometimes as high as 105°F [40.5°C])
- Red, hot, usually dry skin
- Lack of or reduced perspiration
- Skin may still be moist or the victim may stop sweating and the skin may be red, hot, and dry;

- Rapid, weak pulse or rapid, strong pulse;
- Rapid, shallow breathing;
- Nausea;
- Dizziness and confusion; and
- Coma.

2.0 Recommended Treatment for Heat Stress-related Illnesses

2.1 Heat Rash

2.1.1 Treatment for heat rash includes:

- Shower after work, dry off thoroughly, and put on clean, dry underwear and clothes.
- Try to stay in a cool place after work.
- If, in spite of this, you develop heat rash, contact WorkCare.

2.2 Heat Cramps

2.2.1 Treatment for heat cramps includes:

- Gently stretch the cramped muscle and hold the stretch for about 20 seconds, then gently massage the muscle. Repeat these steps if necessary.
- Take more frequent breaks and drink more water.
- Move victim to a cool place.
- Administer drinks of cool water.
- Apply manual pressure to cramped muscles.
- Once spasms disappear, you may return to work.
- Seek medical attention if symptoms are not alleviated or if more serious problems are indicated.

2.3 Heat Exhaustion

2.3.1 Treatment of heat exhaustion includes:

- Get out of the sun to a cool location and drink cool water, a little at a time.
- Remove or loosen tight clothing and elevate the feet.
- If you are nauseated or dizzy, lie down.
- Move the victim to a cool place, administer drinks of cool water and fan to cool.
- Seek medical attention immediately.

2.4 Heat Stroke

2.4.1 Treatment of heat stroke, or if a person's temperature exceeds 102°F (38.9 °C) includes:

- Call for immediate medical help and then try to lower the temperature as quickly as possible:
 - Apply cool (not cold) water the person's whole body, then fan the person.
 - Wrap in wet sheet.
 - If available, use cold packs under arms, neck, and ankles
 - Body temperature is measured frequently, often constantly. To avoid overcooling, cooling is stopped when the body temperature is reduced to about 102°F (38°C).
- Do not give aspirin or acetaminophen to reduce the temperature.
- Treat as a true medical emergency. Seek medical help immediately
- Protect from injury during convulsion.
- Ensure that the person's airway is open.
- Transfer to a medical facility immediately.

GUIDANCE TOOL FOR MONITORING DEHYDRATION

URINE COLORATION CHART

1	2	3	4	5	6
Target		Dehydration		Severe Dehydration	
CONTINUE DRINKING WATER TO MAINTAIN CURRENT HYDRATION LEVELS.		INCREASE WATER CONSUMPTION TO IMPROVE HYDRATION LEVELS, INCREASE BREAKS FREQUENCY, TAKE BREAKS IN A COOL SHADED AREA.		STOP WORK! FIND A SHADED AREA AND BEGIN TO DRINK COOL TO ROOM TEMPERATURE WATER SLOWLY AND STEADILY.	

PREVENTING DEHYDRATION

- Start hydrating at least 3 days prior to working in high heat conditions
- Always bring enough water to maintain hydration. CalOSHA requires consuming 1 quart per hour of your work shift - more may be needed

Note: This information is guidance only and should not supersede the recommendation or instruction of a personal physician or medical professional. Contact your physician or medical professional if you have a personal medical condition or take medication for a personal condition which may be adversely affected by dehydration. Urine color can be affected by medications, vitamins and or other personal health conditions.

Flammable & Combustible Liquids

S3AM-126-PR1

1.0 Purpose and Scope

- 1.1 This procedure applies to all AECOM Americas based employees and operations.
- 1.2 The purpose of this procedure is to provide information regarding the proper storage, handling, and work practices associated with flammable and combustible liquids.

2.0 Terms and Definitions

- 2.1 **Flashpoint** – The minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. The flash point is normally an indication of susceptibility to ignition.
- 2.2 **Safety can** – Safety can: an approved container, of not more than 5 gallons (18.9 liters) capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure

3.0 References

- 3.1 S3AM-011-PR1 Fire Protection
- 3.2 S3AM-115-PR1 Hazardous Material Communication
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM-332-PR1 Hot Work

4.0 Procedure

- 4.1 Implementation of this standard is the responsibility of the AECOM manager directing activities of the facility, site, or project location.
- 4.2 Appoint a Responsible Person who will:
 - 4.2.1 Determine if flammable or combustible liquids are stored on-site. Flammable liquids and combustible liquids are classified or categorized differently by jurisdiction. As a general definition that aligns the different classifications or categories, flammable and combustible liquids are any liquid that has a flashpoint at or below 199.4°F (93°C). Refer to *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications*.
 - 4.2.2 Inspect storage areas monthly.
 - 4.2.3 Monitor the quantity of flammable and combustible liquids on the site.
 - 4.2.4 Review work practices involving flammable and combustible liquids.
 - 4.2.5 Safety data sheets (SDS) for all hazardous substances, including flammable and combustible liquids, must be provided by vendors or subcontractors, and maintained on site. For more information, see *S3AM-115-PR1 Hazardous Material Communication*.
 - 4.2.6 Furnish portable fire extinguishers in such quantities, sizes, and types as needed for the special hazards of operation and storage. For more information, see *S3AM-011-PR1 Fire Protection*.
- 4.3 Control flammable and combustible liquids entering the site by ordering only those materials and quantities needed to complete a job.

4.4 Cylinders – General Use & Transport

- 4.4.1 Open and close cylinder valves using the appropriate tools provided by the cylinder supplier.
- 4.4.2 Remove regulators and replace caps before transporting cylinders.
- 4.4.3 Do not roll or drop cylinders. Transport cylinders in a vertical and secured positing using a cylinder basket, cylinder cart or other secure equipment.
- 4.4.4 Do not use cylinders if the cap cannot be removed by hand. Do not use tools (e.g., hammer) to loosen caps. Tag the cylinder “Do Not Use” and return the cylinder to a designated storage area to be returned to the cylinder supplier.

4.5 General Storage

- 4.5.1 Use only approved containers, tanks, and pumping equipment for storage and handling of flammable and combustible liquids. Use approved (UL or FM) metal safety cans (with spring-closing lid and spout cover, and optional flash-arresting screen) for the handling and use of flammable liquids in 1- to 5-gallon (3.8- to 18.9-liter) quantities. For additional information, see *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications*.
- 4.5.2 Place all rags, waste, etc., soiled by combustible or flammable materials in tightly closed metal containers for daily disposal.
- 4.5.3 Take precautions, including proper ventilation, to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition; chemical reactions; and radiant heat.
- 4.5.4 Require approved personal protective equipment for all persons handling flammable or combustible liquids, as outlined by the appropriate SDS.
- 4.5.5 Train employees exposed to flammable or combustible liquids in the hazards of these materials; in their safe handling, use and disposal; in their protection from ignition sources; in the type, use, and placement of containers and cabinets; in the location of fire extinguishers; in the protection against toxic vapors; and in the procedures to follow in case of spill or fire.

4.6 Indoor Storage

- 4.6.1 Keep indoor storage of flammable liquids to a minimum. Do not store more than 25 gallons (95 liters) of flammable or combustible liquids outside of an approved storage cabinet.
- 4.6.2 Do not store flammable or combustible liquids in areas used for exits, stairways, or normally used for the safe passage of people.
- 4.6.3 Do not store more than of flammable and combustible liquids in a single flammable storage cabinet in excess of that specified by the applicable jurisdiction. Refer to *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications*.
- 4.6.4 Do not store oxidizers and other reactive chemicals in flammable cabinets.
- 4.6.5 Up to three cabinets may be grouped together. Groups of cabinets must be separated by at least 100 feet (30.5 meters).
- 4.6.6 Conspicuously label all cabinets “Flammable — Keep Fire Away.”
- 4.6.7 Indoor flammable liquid storage rooms must conform to NFPA codes, including requirements regarding fire ratings, spill containment, maximum capacity, electrical classifications, and ventilation requirements.

4.7 Outside Storage

- 4.7.1 Maintain a minimum of 20 feet (6.1 meters) between flammable and combustible storage areas and any building.

- 4.7.2 Maintain a minimum distance of 50 feet (15.2 meters) between flammable and combustible storage areas and hot work activities. Refer to *S3AM-332-PR1 Hot Work*.
- 4.7.3 Grade the storage area in a manner to divert possible spills away from buildings, and curb or dike so as to contain entire volume of liquids and prevent spills from impacting soil or groundwater.
- 4.7.4 Keep the entire storage site free from accumulation of unnecessary combustible materials. Closely cut weeds and grass, and establish a regularly scheduled cleanup procedure for the whole area.
- 4.7.5 Maintain adequate access-ways to open-yard storage to allow access by fire-fighting equipment. Equipment that is blocking access must be manned at all times so that it may be readily moved if necessary.
- 4.8 Labeling and Signage
 - 4.8.1 Post a "NO SMOKING OR OPEN FLAME" sign in all areas where flammable and combustible materials are stored, handled, and processed.
 - 4.8.2 Require all containers and cylinders to be labeled with the contents and adequate hazard warnings per *S3AM-115-PR1 Hazardous Materials Communication*.
- 4.9 Use of Materials on Site
 - 4.9.1 Use flammable and combustible liquids in a manner that is consistent with the label and SDS for the product.
 - 4.9.2 Use only those amounts of materials needed for the job. Transfer of these materials to ready-to-use containers is encouraged.
 - 4.9.3 Use personal protective equipment stated on the product label and SDS. For additional information, consult *S3AM-208-PR1 Personal Protective Equipment*.
 - 4.9.4 For dispensing and/or fueling operations, ensure:
 - Signs are posted with instructions on the dispensing or fueling process.
 - Operators have been trained in the dispensing or fueling process.
 - Equipment being refueled has the engine shut off prior to fueling.
 - Smoking is prohibited in vehicle and equipment refueling areas.
 - Adequate protection is provided to safeguard dispensing pumps from physical damage from vehicles.
 - Dispensing nozzles have auto shut-off or self-closing valves and provisions for containing or controlling over-spillage.
 - Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, is of an approved type, and where feasible, is installed at least 8 feet (2.4 meters) above the floor.
 - Tank cars and trucks being loaded or unloaded and flammable storage tanks and systems are properly bonded and grounded.
 - Transfer of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded).
 - Proper PPE is required during the dispensing or fueling process. For additional information, see *S3AM-208-PR1 Personal Protective Equipment*; and *S3AM-126-FM1 Flammable and Combustibles Inspection*.

4.10 Spill Control

- 4.10.1 Have a written spill response plan in place before materials are stored or used on site.
- 4.10.2 Have spill clean-up materials in the vicinity of the materials being stored.
- 4.10.3 Clean up or respond to spills promptly according to applicable local, state, and federal regulations. This may require notification of authorities if a Reportable Quantity (RQ) is exceeded.
- 4.10.4 Move leaking cylinder to a ventilated area away from ignition sources. Do not attempt to repair a leaking cylinder. Contact the cylinder supplier to determine proper response methods.

4.11 Disposal

- 4.11.1 Keep solvent waste and flammable liquids in fire-resistant, covered containers until they are removed from the worksite.
- 4.11.2 Do not place flammable or combustible waste in municipal garbage.
- 4.11.3 Do not pour flammable or combustible liquids down drains or onto the ground.
- 4.11.4 Dispose of flammable or combustible hazardous materials with a licensed and approved hazardous material disposal company.

4.12 Inspection

- 4.12.1 Inspect flammable and combustible storage and use areas on a monthly basis.
- 4.12.2 Use *S3AM-126-FM1 Flammable & Combustibles Inspection* or equivalent to inspect the storage areas.
- 4.12.3 Inspect cylinder regulators, gauges, valves, hoses and connections before use. Any damaged equipment shall be tagged out-of-service.

4.13 Training

- 4.13.1 Require that hazard communication training includes specific hazard information for the flammables and combustibles used.

4.14 Compliance

- 4.14.1 Review and comply with country and client/customer-specific requirements.

5.0 Records

5.1 The following information will be maintained in the project file.

- 5.1.1 Location of the SDS inventory.
- 5.1.2 Completed *S3AM-126-FM1 Flammable & Combustibles Inspection* or equivalent.

6.0 Attachments

- 6.1 S3AM-126-ATT1 Flammable & Combustible Liquid Classifications
- 6.2 S3AM-126-FM1 Flammable & Combustibles Inspection

Americas

Flammable & Combustibles Inspection

S3NA-126-FM1

Location Inspected: _____ Job No.: _____

Date Inspected: _____ Name of Inspector: _____

Fillable fields in the item description shall be completed with the applicable jurisdictional requirement.			
Storage Cabinets			
1.	Flammable cabinets do not obstruct room exits.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
2.	No more than _____ gallons (_____ liters) of flammable or _____ gallons (_____ liters) of combustible liquid are stored in a cabinet.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
3.	No more than three cabinets are located in a storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
4.	Metal storage cabinets have self-closing doors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
5.	Cabinets are labeled "FLAMMABLE – KEEP FIRE AWAY"	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
Safety Cans			
6.	Safety cans are constructed of stainless steel, Monel, or tin.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
7.	Safety cans have a flame arrestor and spring-loaded cap on both the filling and pouring spouts.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
8.	Safety cans have a flame arrestor and spring-loaded cap on both the filling and pouring spouts.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
Drum & Drum Storage Areas			
9.	Drums are stored in a vertical position.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
10.	Bungs are closed when liquid is not being transferred.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
11.	Drums are shielded from the sun.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
12.	Funnels with installed flash arrestor are used when transferring flammable liquids into drums.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
13.	A minimum distance of 25 feet (7.6 meters) between a drum storage area and buildings is present.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
14.	A "NO SMOKING" sign is posted in the area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
15.	An emergency spill kit is located near the drum storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
16.	A 20-pound dry-chemical fire extinguisher is located no less than 10 feet (3 meters) or more than 50 feet (15 meters) from the storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
Waste Cans			
17.	Combustible scrap, debris, and waste materials (oily rags, etc.) are stored in covered metal cans.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
18.	Waste cans are removed from the work area daily.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA
19.	Waste cans have spring-loaded self-closing lids.	<input type="checkbox"/> Yes	<input type="checkbox"/> No <input type="checkbox"/> NA

Storage Rooms Designed Specifically For Flammable Materials			
20. Room construction meets NFPA fire-resistance requirements.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
21. Rooms with automatic extinguishing systems have the following:			
• Noncombustible liquid-tight raised sills or ramps at least 4 inches (0.36 meters) in height.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Flooring at least 4 inches (0.36 meters) below the surrounding floor, or an open-grated trench that drains to a safe location.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Openings with approved self-closing fire doors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Liquid-tight construction where the walls join the floors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Shelving, racks, dunnage floor overlay, and other interiors with 1-inch wood.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
22. Rooms are ventilated by a gravity or mechanical exhaust system that:			
• Commences not more than 1 foot (0.3 meter) above the floor.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Is designed to provide for a complete change of air within the room at least six times per hour.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Is controlled by a switch located outside the door, with ventilating equipment and any light fixtures operated from the same switch.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Flammable & Combustible Storage Areas Within Buildings			
23. At least one portable fire extinguisher rated not less than 20-B is located outside of but not more than 10 feet (3 meters) from the door opening into any room used for the storage of more than _____ gallons (_____ liters) of flammable or combustible liquids.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
24. Buildings or rooms are locked when not occupied.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
25. Exits, stairways, or passageways are not used for storing flammables and combustibles.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
26. No more than _____ gallons (_____ liters) of _____ liquids or _____ gallons (_____ liters) of _____ liquids are located in a room outside of a flammable storage locker or flammable storeroom.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
27. An aisle at least 3 feet (0.91meters) wide is maintained in storage areas.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
28. No more than those amounts needed for one day's use are stored in buildings under construction.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Outside Storage of Flammable and Combustible Liquids			
29. At least one portable fire extinguisher having a rating of not less than 20-B is located not less than 25 feet (7.6 meters) or more than 75 feet (22.8 meters) from any outside flammable liquid storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
30. For containers not more than _____ gallons each (_____ liters), no more than _____ gallons (_____ liters) in any one group are stored.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
31. Groups of containers are separated by 5-foot (1.52 meters) clearances.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
32. Groups of containers are more than 50 feet (15 meters) from buildings.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
33. Portable tanks (not exceeding _____ gallons [_____ liters] in capacity) are provided with emergency venting devices as specified by NFPA 30.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
34. Storage areas are free of accumulation of weeds, debris, and other combustible materials not necessary to the storage.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA

Storage Tanks			
35. Tanks have relief vents.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
36. Tank vents are not close to open flames, stacks, heating apparatus, or any other source of ignition.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
37. Tanks are double-walled or a dike, curb, or other suitable means is present to prevent the spread of leakage from tanks.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
38. Diked areas have a capacity equal in volume to at least that of the largest tank plus 10 percent of all other tanks in the enclosure.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
39. Provisions to drain off accumulations of ground- or rainwater or spills in diked areas.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
40. Tanks are vented outdoors and away from air intakes and windows.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
41. Impact protection, such as bollards or guard rails, is present for tanks located in areas susceptible to impacts from vehicles or other moving equipment.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Dispensing of Flammable and Combustible Liquids			
42. Dispensing outlets for above-ground tanks with nationally listed automatic-closing valve, without a latch-open device.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
43. Dispensing systems are electrically bonded and grounded.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
44. Tanks, hoses, and containers of 5 gallons (19 liters) or less in metallic contact while transferring flammable liquids (grounding).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
45. Electrically bonded systems are used for transferring flammable liquids in containers in excess of 5 gallons (19 liters).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
46. Closed piping systems are used for drawing flammable liquids during transfer.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
47. Flammables and combustibles are drawn from a container or portable tank by use of gravity or through a pump using an approved self-closing valve.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Liquefied Petroleum Gas – Refueling			
48. Equipment is shut down during refueling operations.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
49. Leather gloves and safety glasses are worn during refueling operations.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
50. Smoking and hot work is prohibited during refueling.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
51. Refueling occurs at least 25 feet (7.6 meters) from buildings.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Oxidizers			
52. Oxidizers are stored separately from flammables.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
53. When oxidizers are shifted to a second container, the container is labeled with the appropriate warning labels.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
54. Secondary containers are compatible with oxidizers.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
55. Oxidizers are stored away from heat sources where the maximum temperature exceeds 100° F (37.8° C).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
56. Chromic acid, nitric acid, perchloric acid, and potassium permanganate (all oxidizers) are stored separately from other corrosives and flammables.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA

Flammable & Combustible Liquid Classifications

S3NA-126-ATT1

NFPA 30, WHMIS Canada

Flammable Liquid	Flash Point	Boiling Point
Class 1A	< 73° F (22.8°C)	< 100° F (37.8°C)
Class 1B	< 73° F (22.8°C)	> 100° F (37.8°C)
Class 1C	> 73° F (22.8°C) < 100° F (37.8°C)	
Combustible Liquid		
Class 2	> 100° F (37.8°C) < 140° F (60°C)	
Class 3A	≥ 140° F (60°C) < 200° F (93.3°C)	
Class 3B	> 200° F (93.3°C)	

Do not store more than 25 gallons (95 liters) of Class 1A liquids in containers of flammable or combustible liquids outside of an approved storage cabinet.

Do not store more than 120 gallons (454 liters) of Class 1B, 1C, 2, or 3 liquids in containers of flammable and combustible liquids in a single flammable storage cabinet.

Maximum Allowable Size of Containers and Portable Tanks

Container Type	Flammable Liquids			Combustible Liquids	
	Class 1A	Class 1B	Class 1C	Class II	Class III
Glass or approved plastic	1 pint (0.5 liter)	1 quart (1 liter)	1.3 gallons (5 liters)	1.3 gallons (5 liters)	1.3 gallons (5 liters)
Metal (other than drums) or approved plastic	1.3 gallons (5 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)
Safety cans	2.6 gallons (10 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)	5.3 gallons (20 liters)
Metal drums (DOT specifications)	119 gallons (450 liters)	119 gallons (450 liters)	119 gallons (450 liters)	119 gallons (450 liters)	119 gallons (450 liters)
Approved metal portable tanks	793 gallons (3,000 liters)	793 gallons (3,000 liters)	793 gallons (3,000 liters)	793 gallons (3,000 liters)	793 gallons (3,000 liters)

OSHA 29 CFR 1910.106

Flammable Liquid	Flash Point	Boiling Point
Category 1	< 73.4° F (23°C)	< 95° F (35°C)
Category 2	< 73.4° F (23°C)	> 95° F (35°C)
Category 3*	> 73.4° F (23°C) < 140° F (60°C)	
Category 4**	>140°F (60°C) ≤199.4°F (37.8°C)	

* When a Category 3 liquid with a flashpoint at or above 100 °F (37.8 °C) is heated for use to within 30 °F (16.7 °C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint below 100 °F (37.8 °C).

** When a Category 4 flammable liquid is heated for use to within 30 °F (16.7 °C) of its flashpoint, it shall be handled in accordance with the requirements for a Category 3 liquid with a flashpoint at or above 100 °F (37.8 °C).

Maximum Allowable Size of Containers and Portable Tanks

Container Type	Flammable Liquids			
	Category 1	Category 2	Category 3	Category 4
Glass or approved plastic	1 pint (0.5 liter)	1 quart (1 liter)	1 gallons (3.8 liters)	1 gallons (3.8 liters)
Metal (other than drums) or approved plastic	1 gallons (3.8 liters)	5 gallons (18.9 liters)	5 gallons (18.9 liters)	5 gallons (18.9 liters)
Safety cans	2 gallons (7.6 liters)	5 gallons (18.9 liters)	5 gallons (18.9 liters)	5 gallons (18.9 liters)
Metal drums (DOT specifications)	60 gallons (227 liters)	60 gallons (227 liters)	60 gallons (227 liters)	60 gallons (227 liters)
Approved metal portable tanks	660 gallons (2498 liters)	660 gallons (2498 liters)	660 gallons (2498 liters)	660 gallons (2498liters)

Not more than 60 gallons (227 liters) of Category 1, 2 and/or 3 flammable liquids or 120 gallons (454 liters) of Category 4 flammable liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area. Quantities in excess of this shall be stored in an inside storage room.

Storage of containers (not more than 60 gallons [227 liters] each) shall not exceed 1,100 gallons (4164 liters) in any one pile or area. Piles or groups of containers shall be separated by a 5-foot clearance. Piles or groups of containers shall not be nearer than 20 feet (6.1 meters) to a building.

Electrical Safety

S3AM-302-PR1

1.0 Purpose and Scope

- 1.1 Outline the safe working requirements for working with and near electric equipment and installations to minimize and control electrical hazards such as electrical shock, arc flash, and electrical fires in the workplace.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.
- 1.3 As a general rule, AECOM employees shall not work on exposed, energized systems with a potential greater than 50 volts. This work should be performed by a qualified electrician.

2.0 Terms and Definitions

- 2.1 **Arc Flash** – A dangerous condition associated with the release of energy during an electrical arc.
- 2.2 **Arc Flash Analysis** – A mathematical determination of the energy released by an electric arc and the distance from the source that a flash hazard exists. The process for an Arc Flash Analysis is defined in National Fire Protection Act 70E of the National Electric Code and Canadian Standards Association Z462.
- 2.3 **Arc Rating** – The maximum incident energy resistance demonstrated by a material prior to breakdown or at the onset of a second-degree skin burn (expressed in cal/cm²).
- 2.4 **Circuit Protective Device** – A load-rated switch, circuit breaker, or other device specifically designed as a disconnecting means for opening, reversing, or closing of live circuits.
- 2.5 **Energized Electrical Equipment** – Electrically connected to or having a source of voltage.
- 2.6 **Flash Hazard** – A dangerous situation associated with the release of energy caused by an electric arc.
- 2.7 **Ground Fault Circuit Interrupter (GFCI)** – An electrical device that protects the users of all devices connected to it from electrical shock. The GFCI is part of the circuit or device in use and continuously measures the current in that circuit. If a leakage of current is detected, as in the case of an electrical short circuit, the circuit is opened at the GFCI and current cannot flow beyond the GFCI.
- 2.8 **Licensed Electrician** – A person who possesses the local licenses and certifications to work on electrical circuitry, panels or equipment if full compliance with local legislation.
- 2.9 **Portable Electric Equipment** – Cord- and plug-connected equipment and extension cords.
- 2.10 **Qualified Persons** – Individuals who have specific and documented training and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations to avoid the hazards of working on or near energized electrical equipment. Qualified Persons shall have been specifically permitted to near exposed energized and parts. Even an experienced electrician is unqualified unless he or she knows the particular equipment and has received specific safety training on the potential hazards involved.
- 2.11 **Shock Hazard** – A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-202-PR1 Competent Person Designation
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM-209-PR1 Risk Assessment & Management

- 3.5 S3AM-218-PR1 Permit to Work
- 3.6 S3AM-305-PR1 Hand & Power Tools
- 3.7 S3AM-322-PR1 Overhead Lines
- 3.8 S3AM-325-PR1 Lockout Tagout
- 3.9 S3AM-410-PR1 Hazardous Energy Control

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager / Supervisor

- Approve all Energized Electrical Work Permits.
- Confirm that all projects under their direct control or authority have a written SH&E Plan prepared for the activity.
- Confirm communication with client / owner of hazards presented by the work conducted by AECOM and controls measures in place.
- Provide technical guidance in support of this procedure.
- Confirming employees are informed of and comply with the provisions of this procedure.
- Supporting employees in the reporting of incidents per *S3AM-004-PR1 Incident Reporting, Notifications & Investigations*, including the entry of the incident into the on-line incident management system (e.g. IndustrySafe).

4.1.2 SH&E Manager

- Provide technical guidance and support to the Manager or Supervisor.
- Assist the Manager or Supervisor in compliance with the requirements of this procedure.
- Assist in the incident investigation and review process

4.1.3 Employees

- Comply with requirements of this procedure.
- Stop work if workers, other than Qualified Persons, are exposed to live electrical systems at unknown voltages or potentials greater than 50 volts.
- Only open electrical panels only if they are a Qualified Person.
- Employees designated as a Qualified Person, conduct work on or near energized electrical equipment in accordance with applicable training and jurisdictional requirements.
- Employees designated as a competent person in relation to the Assured Equipment Grounding Conductor Program, administer testing and recording in accordance with jurisdictional requirements.
- Immediately report incidents per *S3AM-004-PR1 Incident Reporting, Notifications & Investigations*, including the entry of the incident into the on-line incident management system (e.g., IndustrySafe).

4.2 Training

- 4.2.1 Employees who have potential exposures to electrical hazards shall be trained in and be familiar with the electrical safety-related work practices required by the applicable regulations. Refer to the *S3AM-003-PR1 SH&E Training* for specific required training.
- 4.2.2 Employees shall have reviewed and acknowledged the applicable SH&E plan specific to the project or location.

- 4.2.3 Refer to *S3AM-302-ATT1 Live Electrical Work* for qualifications if working on or near exposed electric conductors or circuit parts that can be energized.

4.3 General Requirements

- 4.3.1 Electrical outlets utilized to supply power for electrical equipment during field operations shall be of the three-wire grounding type. They should be tested for correct polarity and adequacy of the ground with a circuit analyzer. If it is determined that the outlet is incorrectly wired or inadequately grounded, it must not be used until serviced by a licensed electrician.
- 4.3.2 GFCI devices will be in place between the equipment and power source for all temporary circuits unless protected by an assured equipment grounding program as defined in this procedure (i.e., circuits that are not part of a permanently installed facility electrical system, such as on a construction site or temporary field installation).
- 4.3.3 Unqualified personnel are not permitted to work on electrical equipment unless it has been de-energized, verified as being free of hazardous energy and locked and tagged out in accordance with *S3AM-325-PR1 Lockout Tagout*.
- Electrical equipment that has been de-energized but not locked and tagged out shall be treated as energized.
- 4.3.4 After a circuit is de-energized by a circuit protective device, the circuit may not be repeatedly manually reenergized until it has been determined that the equipment and circuit can be safely energized.
- 4.3.5 Temporary or permanent light fixtures that present a shock or burn hazard shall be guarded.
- 4.3.6 Confirm power switches are properly labeled to identify what they control, unless this is clearly confirmed through switch proximity or location. Electric conductors shall be protected from damage.

4.4 Classified Locations

Electrical equipment and wiring may be installed in locations where any of the following may be present: flammable vapors, liquids, or gases; combustible dusts or fibers; or a concentration or quantity of flammable or combustible material. Below is a list of each type of location and the associated hazards.

4.4.1 Class I Locations

Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations include the following:

A. Class I, Division 1 location is a location:

1. In which ignitable concentrations of flammable gases or vapors may exist under normal operating conditions; or
2. In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or
3. In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

B. Class I, Division 2 location is a location:

1. In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment; or

2. In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or
3. That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

4.4.2 Class II Locations

Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include the following:

- A. Class II, Division 1 location is a location:
 1. In which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures; or
 2. There mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes, or
 3. In which combustible dusts of an electrically conductive nature may be present.
- B. Class II, Division 2 location is a location in which:
 1. Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or
 2. Dust may be in suspension in the air as a result of infrequent malfunction of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

4.4.3 Class III Locations

Class III locations are those that are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include the following:

- A. Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.
- B. Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.

4.5 Distribution System Setup

- 4.5.1 Under no circumstances shall electrical lines be routed through doorways, hatches, windows, or other openings.
- 4.5.2 Electric lines crossing work areas, personnel, or vehicular traffic areas shall be either fastened securely overhead (at a height that provides safe clearance for work operations), or protected by a cover capable of withstanding the imposed loads without creating a trip hazard.
- 4.5.3 Circuit breakers shall be labeled to indicate their use.
- 4.5.4 All circuit breaker panels shall have no openings or uncovered knockouts and shall be kept covered when not in use.
- 4.5.5 All live parts of electrical equipment operating at 50 volts or more shall be properly guarded against accidental contact.
- 4.5.6 Extension Cord Use

- Extension cords and electrical connections on handheld and other power tools will be inspected prior to use for cuts, kinks, frayed wires, etc. If any deficiency is noted, the equipment will be tagged "OUT OF SERVICE" and removed from service. Manufacturer-installed insulated electrical cords will not be repaired except by a licensed electrician.
- Extension cords are not to be placed across aisles, through doors, through holes in a wall, or in areas where the cord may be damaged or create a tripping hazard.
- Extension cord sets for use in field operations should be of the three-wire grounding type and will be rated for the intended load.
- Use of extension cords is allowed only for temporary installations not to exceed 90 days.
- Extension cords shall be provided with a plug cap that is either molded to the cord or equipped with a cord clamp to prevent strain on the terminal screws.
- Extension cords shall not be fastened with staples or otherwise hung in a manner that could damage the outer jacket or insulation.
- Ground fault circuit interrupters shall be used or, if permitted by legislation, an "assured equipment grounding conductor program" is to be established for all nonpermanent wiring needed for construction purposes or when working outdoors, in wet or moist areas or elsewhere as required by legislation.

4.5.7 Temporary Lights/Task Lights

- A temporary light shall not be suspended by the cord unless the cord and light are designed for suspension.
- Temporary lights shall be equipped with bulb protectors unless they are installed at least 7 or more feet overhead.

4.6 Working on or Near Energized Parts

- 4.6.1 Working on or near energized parts covers either potential direct physical contact or contact by means of tools or equipment and working close enough to the energized part to draw an arc.
- 4.6.2 Any work on exposed, live electrical systems above 50 volts shall be conducted by a licensed electrician who is a Qualified Person.
- 4.6.3 Refer to *S3AM-302-ATT1 Live Electrical Work*.
- 4.6.4 Prior to performing any work near exposed, energized systems, the Qualified Person shall:
 - Confirm with the Licensed Electrician that it is safe to do so.
 - Perform a Shock Hazard Analysis.
 - Perform an Arc Flash Analysis.
 - Establish emergency contacts.
 - Complete and have approved the Energized Electrical Work Permit. Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
 - Have all required personal protective equipment (PPE), insulated tools, and test equipment tested and ready to use.
 - Know and understand the procedures to be followed.
 - Ensure that adequate lighting and clearance space is available.
 - Remove all conductive clothing and jewelry.
- 4.6.5 Working Near Overhead Power Lines
 - Personnel working in the vicinity of overhead power lines, either on the ground or elevated, shall comply with *S3AM-322-PR1 Overhead Lines*.

- All workers and equipment including cranes and drill rigs shall maintain a clearance distance of at least 50 feet (15.24m meters) from overhead power lines unless a detailed assessment has been completed demonstrating that a smaller clearance distance provides protection.

4.7 Grounding

4.7.1 "Ground fault protection" is required on construction sites. To provide this protection, either "ground fault circuit interrupters" (GFCI) are to be used with temporary receptacles, or if permitted by legislation an "assured equipment grounding conductor program" is to be established in which plug-connected electrical equipment, extension cords, and temporary receptacles are tested on a periodic basis.

4.7.2 Ground Fault Circuit Interrupters

- A GFCI is an electrical device that is designed to prevent electrocution from electrical leakage. It is designed to measure the difference in amperage between the "hot" wire and the "neutral" wire in a circuit. Under ideal conditions, the amperage should be the same in both wires. If there is electrical leakage (a ground-fault), the amperages will be different. If the difference is more than a predetermined amount, the GFCI "trips" and stops the flow of electricity.
- GFCIs may trip from many causes including but not limited to:
 - Electrical leakage in the tool from internal defects, damaged insulation or from normal leakage in long runs of cords.
 - Moisture in the air or cords lying in water or on moist dirt.
 - Too many tools on one GFCI circuit.
 - Faulty wiring of the GFCI into the circuit.
 - Defective GFCI.
 - Any such tripping will require the problem to be corrected before the protected circuit can be re-set.

4.7.3 All 120-volt, single-phase, 15- and 20-ampere temporary receptacles shall be protected with "approved" GFCIs. "Approved" means listed by Underwriters Laboratories.

4.7.4 There are several types of GFCIs.

- A combination circuit breaker and GFCI that is installed in place of the ordinary circuit breaker.
- A receptacle containing a built-in GFCI.
- A portable GFCI that plugs into a receptacle and allows the extension cord or tool to be plugged into the GFCI.
- A portable unit containing several GFCI protected receptacles.

4.7.5 GFCIs contain a test button and a reset button. Each GFCI needs to be tested prior to use and on a periodic basis depending upon the manufacturer's recommendations (at a minimum monthly).

4.7.6 Assured Equipment Grounding Conductor Program

- If allowed by local legislation, assured equipment grounding conductor program is to be used instead of GFCIs to provide ground fault protection, the program shall be governed by the following requirements.
- Temporary receptacles shall be electrically grounded in accordance with the temporary wiring requirements of the National Electrical Code (United States)/Canadian Electrical Code.
- Extension cords shall be three-wire cords containing an equipment grounding conductor (ground wire).
- Electrical equipment that is plugged into a receptacle or extension cord (portable electrical tools, bench grinders, electric heaters, etc.) shall have a ground wire properly attached to the

non-current-carrying metal parts of the equipment. (Double-insulated tools have no ground wire and are therefore exempt from these testing and recording requirements but still need to be inspected for defects.)

- The Manager or Supervisor is required to designate one or more competent persons to administer this testing and recording program. Refer to S3AM-202-PR1 Competent Person Designation.
- Periodic testing of all plug connected equipment, all extension cords, and all temporary receptacles is to be conducted at the following times:
 - Before a new item (equipment, cord, or receptacle) is put into use.
 - After any repairs to the item.
 - After any incident in which the item may have been damaged.
 - Within three months of the last test. (An exception is allowed in the Standard in which extension cords, and temporary receptacles, which are fixed in place and are not exposed to damage, may be tested every months months.)
- The purpose of the test is to determine the following:
 - Temporary receptacles—to be sure that the receptacle is grounded.
 - Extension Cords—to be sure that the ground wire is connected to the proper terminal at each end and that the ground wire is continuous throughout the length of the cord.
 - Plug Connected Equipment—to be sure that the ground wire is connected to the proper terminal and to the non-current carrying metal parts of the equipment and that the ground wire is continuous from the equipment to the plug.
- The tests may be conducted using the following instruments:
 - A receptacle tester may be used to test receptacles and to test extension cords when plugged into a receptacle.
 - A continuity tester, or a volt-ohm meter, may be used to test equipment and to test extension cords when not plugged into a receptacle.
- Records must be kept to show which items have passed the test and when the test was conducted. These records may be either written inspection logs, a color-coding system using colored tape attached to the item, or some other effective means.
- Color coding shall be used in the following manner:
 - After a plug-connected piece of equipment or an extension cord has been inspected and passed the test, colored tape is to be placed around the cord near the plug. After a temporary receptacle has passed the test, colored tape is to be placed on the cover plate.
 - Any set of colors may be used, with the exception of white, black, or silver.
 - If there has been no overall site requirements established by the general contractor, use the following colors for the test periods.

January, February, March	Red
April, May, June	Blue
July, August, September	Orange
October, November, December	Green

- The tests administered every three months are to begin on the first working day of each quarter. Testing and color coding are to be continued until all items covered by this program have been tested. The test administered every six months, for those receptacles and extension

cords needing only semi-annual testing, are to be color coded using the quarterly color current at the time of the semi-annual test.

- A visual inspection of plug-connected equipment, extension cords, and temporary receptacles is to be made by the user before each use. The purpose of the visual inspection is to look for damage or defects that could affect the safe use of the item. (Exception: extension cords and temporary receptacles that are fixed in place and not exposed to damage are not required to be given a daily visual inspection, but it is a good idea to do the daily visual inspection anyway.)
- Equipment, cords, or receptacles showing damage or defects that could affect its safe operation are not to be used. This applies not only to the visual inspection before each use but also applies to any evidence of damage observed any time during use. Damaged items are to be taken out of service and are not to be used until properly repaired and retested.
- Equipment covered by this program is not to be used until the equipment has been tested and color coded according to the requirements of this program.
- A copy of this program is to be kept at the worksite.

4.8 PPE/Work Practices

4.8.1 PPE requirements shall be determined based on the results of each of the following: Task Hazard Analysis, Shock Hazard Analysis, and Arc Flash Analysis. Refer to the *S3AM-208-PR1 Personal Protective Equipment* and *S3AM-302-ATT1 Live Electrical Work*.

4.8.2 PPE

2 – Required PPE (range based on maximum voltage)	
50 to 240 volts	<ul style="list-style-type: none"> • <u>Eye/Face:</u> Safety glasses with side shields or goggles and Arc-Flash Face Shield or Arc-Flash Suit Hood (4 cal/cm²) • <u>Body:</u> Flame-Retardant long-sleeved shirt/pants or coverall (4 cal/cm²) • <u>Hand:</u> Electrical Hazard (EH) gloves (Class 00 with leather protectors) • <u>Foot:</u> EH-rated footwear • <u>Head/Ears:</u> Class E hard hat, hearing protection (ear canal inserts) • <u>Tools:</u> ANSI/CSA-approved, voltage-rated
Above 240 to 480 volts	<ul style="list-style-type: none"> • <u>Eye/Face:</u> Safety glasses with side shields or goggles and Arc-Flash Face Shield and Sock Hood (8 cal/cm²) or Arc-Flash Suit Hood (8 cal/cm²) • <u>Body:</u> Flame-Retardant long-sleeved shirt/pants or coverall (8 cal/cm²) • <u>Hand:</u> EH gloves (Class 00 with leather protectors) • <u>Foot:</u> EH-rated footwear • <u>Head/Ears:</u> Class E Hard hat, hearing protection (ear canal inserts) • <u>Tools:</u> ANSI/CSA-approved, voltage-rated
480 to 600 volts	<ul style="list-style-type: none"> • <u>Eye/Face:</u> Safety glasses with side shields or goggles and Arc-Flash Suit Hood (8 cal/cm²) • <u>Body:</u> Flame-Retardant long-sleeved shirt/pants or coverall (8 cal/cm²) • <u>Hand:</u> EH gloves (Class 0 or higher with leather protectors) • <u>Foot:</u> EH-rated footwear (carbon fiber recommended) • <u>Head/Ears:</u> Class E Hard hat, hearing protection (ear canal inserts) • <u>Tools:</u> ANSI/CSA-approved, voltage-rated

4.9 Portable Electrical Equipment

4.9.1 Refer to *S3AM-305-PR1 Hand & Power Tools*.

5.0 Records

- 5.1 The Shock Hazard Analysis and the Arc Flash Analysis forms shall be retained in the project file.
- 5.2 The completed *S3AM-302-FM1 Energized Electrical Work Permit* or equivalent shall be retained in the project file.

6.0 Attachments

- 6.1 [S3AM-302-FM1 Energized Electrical Work Permit](#)
- 6.2 [S3AM-302-FM2 Electrical Hazard Checklist](#)
- 6.3 [S3AM-302-ATT1 Live Electrical Work](#)
- 6.4 [S3AM-302-ATT2 Generator Safety](#)

Americas

Energized Electrical Work Permit

PART 1: To be completed by the requester

Job Work Number _____

- (1) Description of circuit/equipment/job location: _____
- (2) Description of work to be done: _____
- (3) Justification of why the circuit/equipment cannot be de-energized or the work cannot be deferred until the next scheduled outage: _____

Requester/Title _____ Date/Time _____

PART II: To be completed by the electrically qualified persons *doing* the work:

- | | Check When
Complete |
|---|--|
| (1) Detailed job description procedure to be used in performing the above detailed work: | <input type="checkbox"/> |
| (2) Description of the Safe Work Practices to be employed: | <input type="checkbox"/> |
| (3) Results of the Shock Hazard Analysis: | <input type="checkbox"/> |
| (4) Determination of Shock Protection Boundaries: | <input type="checkbox"/> |
| (5) Results of Flash Hazard Analysis: | <input type="checkbox"/> |
| (6) Determination of the Flash Protection Boundary: | <input type="checkbox"/> |
| (7) Necessary personal protective equipment to safely perform the job: | <input type="checkbox"/> |
| (8) Means employed to restrict the access of unqualified persons from the work area: | <input type="checkbox"/> |
| (9) Evidence of completion of a Job Briefing including discussion of any job-related hazards: | <input type="checkbox"/> |
| (10) Do you agree that the above described work can be done safely?
(If <i>no</i> , return to requester) | <input type="checkbox"/> Yes <input type="checkbox"/> No |

 Electrically Qualified Persons(s)

 Electrically Qualified Persons(s)

Authorized by: _____

Authorized Supervisor _____ Date/Time _____

Notes: _____

Americas

Electrical Hazard Checklist

S3NA-302-FM2

Location Inspected: _____ Job No.: _____

Date Inspected: _____ Name of Inspector: _____

Check Yes, No, or NA for Not Applicable. If a comment is required, circle the number, and see Page 3.

Electrical Equipment Markings

- | | | | | |
|----|--|------------------------------|-----------------------------|-----------------------------|
| 1. | Disconnecting switches and circuit breakers are labeled to indicate their use or equipment served. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 2. | The necessary voltage, wattage, or current ratings are labeled. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 3. | Circuit breakers clearly indicate whether they are in the "on" or "off" position. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 4. | Markings for arc flash hazards per NFPA 70E or CSA Z462 are on each panel or distribution box. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Electrical Grounding

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 5. | Extension cords used have a grounding conductor (third plug). | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 6. | Ground-fault circuit interrupters (GFCIs) are installed as required or an assured equipment grounding conductor program is in use. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 7. | Portable electrical tools and equipment are of the double-insulated type. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 8. | GFCIs open the circuit on a ground current of 5 milliamperes or greater, and are equipped with an integral push-button test circuit. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 9. | GFCIs are installed in accordance with the manufacturer's instructions. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 10. | Ground-fault circuit interrupters are tested prior to initial use, and periodically thereafter. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 11. | Grounding rods are at least 5/8-inch- (0.625-centimeter)-diameter steel or iron rods, 1/2-inch- (1.27-centimeter)-diameter copper-clad steel, or 3/4-inch-(1.9-centimeter)-diameter galvanized pipe. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 12. | Grounding rods are in 8-foot (2.5-meter) lengths and driven to full depth. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 13. | The paths from circuits, equipment, structures, and conduits or enclosures to ground are: | | | |
| | • Permanent and continuous. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| | • Have ample carrying capacity for current likely to be imposed on them. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| | • Have resistance sufficiently low to permit current flow to operate circuit breakers and similar overcurrent devices on the circuit. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 14. | Driven ground-rod electrodes have a resistance to ground not exceeding 25 ohms. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 15. | Upon installation of the driven ground-rod electrode, the resistance was tested and recorded. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 16. | Conductors, used for bonding and grounding circuits, are of sufficient size to carry the anticipated current. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 17. | Grounds are not removed until all work is complete. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Electrical Guarding

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 18. | Switches, receptacles, etc., are provided with tight-fitting covers or plates. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 19. | All energized parts of electrical circuits and equipment are guarded against accidental contact by approved cabinets or enclosure. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 20. | All unused openings (including conduit knockouts) in electrical enclosures and fittings are enclosed with appropriate covers, plugs, or plates. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 21. | Ground-fault circuit interrupters are installed on each temporary 15- or 20-ampere, 120-volt AC circuit at locations where construction, demolition, modifications, alterations, or excavations are being performed. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 22. | Electrical switches and breakers (rated 440 volts or greater) are provided with a means for locking them out in the OFF position. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Electrical Systems

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 23. | Circuit breakers accessible to personnel are protected from physical damage, and located away from ignitable material. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 24. | Weatherproof cabinets or enclosures are used when switches, circuit breakers, fuse panels, and motor controllers are in a wet or outside location. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 25. | A readily accessible, manually operated switch is provided for each incoming service or supply circuit rated less than 5 kilovolts. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 26. | Electrical raceways and enclosures are securely fastened in place. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 27. | Overcurrent protection is provided for fuses or circuit breakers for each feeder and branch circuit. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 28. | Insulating fuse tongs or extractors are used when removing fuses from circuits rated 50 to 600 volts. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 29. | Fuse cabinets have close-fitting doors that can be locked. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Extension Cords

- | | | | | |
|-----|---|------------------------------|-----------------------------|-----------------------------|
| 30. | Clamps or other securing means are provided on flexible cords or cables at plug receptacles, tools, equipment, etc., and the cord jackets are securely held in place. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 31. | Flexible cords and cables are free of splices and taps. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 32. | Only 3-wire grounded-type extension cords, designated for hard or extra-hard service, are used. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 33. | Extension cords are listed by Underwriters Laboratories, Inc. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 34. | Extension cords are checked for damage before use. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 35. | The rated load on extension cords is not exceeded. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 36. | Extension cords are of adequate length and multiple cords are not connected together. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 36. | Extension cords are not fastened with staples, hung by nails, or suspended by wire. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Temporary Wiring

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 37. | Temporary wiring is guarded, buried, or isolated by elevation to prevent accidental contact by workers and equipment. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 38. | A vertical clearance above walkways for temporary wiring is not less than 10 feet (3 meters) from circuits carrying 600 volts or less. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 39. | All exposed temporary wiring is supported on insulators. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 40. | Temporary wiring is protected from accidental damage. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 41. | Nonconductive lamp sockets and connections are permanently molded to the conductor insulation on lighting strings. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 42. | Lighting strings have lamp guards. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 43. | Broken or defective bulbs are replaced promptly. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 44. | Lights are protected from accidental contact or breakage. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 45. | Wiring installed in conduit is equipped with bushings at outlets and terminals. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 46. | Receptacles are of the grounding type, and electrically connected to the equipment-grounding conductor. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Worker Practices

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 47. | Personnel performing electrical repairs are properly trained and qualified. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 48. | Workers de-energize, ground, or guard electrical circuits before working in close proximity to them. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 49. | Workers consider all electrical systems as live until verified de-energized and grounded. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 50. | Proper lockout/tag-out procedures are used for de-energizing electric circuits. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 51. | Arc flash protection protocols are in place for work on circuits of 50 volts or higher. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Equipment

- | | | | | |
|-----|---|------------------------------|-----------------------------|-----------------------------|
| 52. | Only fiberglass or wood ladders are used when working near electrical hazards. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 53. | Insulation mats are placed on floors and on frames of equipment when working on energized equipment. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 54. | Only voltage-rated tools are used on or near live circuits. Voltage rating is appropriate for the work being performed. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Personal Protective Equipment

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 55. | Rubber matting, blankets, insulated sleeves, and rubber gloves are inspected before use. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 56. | Workers use safety glasses and face shields during work activities where there is a reasonable probability of eye injury (and on systems with 50 or more volts). | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 57. | Workers wear arc flash protective clothing, hoods, face shields, and gloves when working on live circuits greater than 50 volts (per NFPA 70E or CSA Z462). | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

COMMENTS:

1.0 Purpose

- 1.1 The purpose of this attachment to *S3AM-302-PR1 Electrical Safety* is to confirm that all live electrical work conducted under the control of AECOM personnel is carried out in accordance with legislation and recognized best practices in order to provide adequate protection to workers from potential arc flash and / or electrical shock.

2.0 Definitions

- 2.1 **Arc Rating** – The maximum incident energy resistance demonstrated by a material prior to breakdown or at the onset of a second-degree skin burn (expressed in cal / cm²).
- 2.2 **Flash Hazard** – A dangerous situation associated with the release of energy caused by an electric arc.
- 2.3 **Energized Electrical Equipment** – Electrically connected to or having a source of voltage.
- 2.4 **Shock Hazard** – A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

3.0 Responsibilities

3.1 Manager

- 3.1.1 Be familiar with all precautions and Federal and State / Provincial regulations and Best Practices.
- 3.1.2 Provide training on this Work Instruction to Qualified Persons covering:
- Nature and control of known shock and arc flash hazards.
 - Means of eliminating and controlling shock and arc flash hazards.
 - Special electrical personal protective equipment (PPE) requirements (task specific).
 - Procedure for reporting any deviations to this Work Instruction.
- 3.1.3 Confirm employees are provided with safe access to the work area.
- 3.1.4 Control access to energized electrical equipment with potential of shock or arc flash to Qualified Persons only.
- 3.1.5 Confirm availability of proper tools for the operation and maintenance of electrical equipment.
- 3.1.6 Proper identification and guarding of potentially hazardous electrical equipment.
- 3.1.7 Providing available electrical one-line diagrams.
- 3.1.8 Confirm proper housekeeping around energized electrical equipment at all times.
- 3.1.9 Provide proper working conditions, including adequate lighting, to facilitate work in a safe environment.
- 3.1.10 Provide proper supervision of employees.
- 3.1.11 Maintaining a list of authorized electrical supervisor, Qualified Person(s), and attendant.
- 3.1.12 Implementation an ongoing evaluation of this Best Management Practice.
- 3.1.13 Terminate the work and cancel the permit when live work has been completed or any new electrical hazard arises.
- 3.1.14 Verify that communication modes are available and have been tested.

- 3.1.15 Remove unauthorized individuals who enter or who attempt to enter the approach boundaries during live work.
- 3.1.16 Confirm that live work remains consistent with terms of the live work permit and that acceptable working conditions are maintained.
- 3.1.17 Withdraw the live work permit and stop all work if unsafe conditions are reported during any live work (e.g. sparking, smoldering etc.). Do not permit work on that equipment until the cause of any unsafe condition is thoroughly investigated and the live work procedure has been reviewed to prevent reoccurrence.

3.2 **Authorized Electrical Attendant**

- 3.2.1 Practice all precautions and Federal and State / Provincial regulations and Best Practices.
- 3.2.2 Understand the hazards that may be faced during live work, including the potential for arc flash, shock hazard, and other related hazards.
- 3.2.3 Be aware of the potential of arc flash or shock possible to the Qualified Persons.
- 3.2.4 Maintain an accurate count of Qualified Persons working near the live equipment or inside approach boundaries.
- 3.2.5 Remain near the approach boundary until relieved by another authorized electrical attendant.
- 3.2.6 Communicate with Qualified Persons as necessary to confirm maintenance of safe conditions at all times.
- 3.2.7 Monitor activities inside and outside the approach zone to determine if it is safe for the worker to continue to remain in the approach zone. Order the Qualified Persons to stop live work under any of the following conditions:
 - The attendant detects a problem;
 - The attendant detects the signs of short-circuiting, such as electrical sparking, smoldering, or any other abnormality;
 - The attendant detects a situation outside the approach zone that could endanger the worker; and
 - If the attendant cannot effectively and safely perform all assigned duties.
- 3.2.8 Perform no other duties that might interfere with the attendant's primary duty to monitor and protect the Qualified Persons.

3.3 **Qualified Persons (Authorized Electrical Worker)**

- 3.3.1 Perform all work in accordance with Federal and State / Provincial regulations, AECOM policies and procedures, and this work instruction.
- 3.3.2 Be continuously alert, focused, and aware of the hazards of performing the task.
- 3.3.3 Understand AECOM Safety, Health and Environmental policies and standards as well as site-specific electrical safe work practices.
- 3.3.4 Examine and understand all the documents provided by AECOM and manufacturers, including all specific hazards, advisories, cautions, etc.
- 3.3.5 Be knowledgeable of the use and selection of the proper tools to safely perform the electrical task safely.
- 3.3.6 Complete a Safe Work Plan prior to the start of a task and during work, if conditions change.
- 3.3.7 Maintain good housekeeping around work areas. Remove all debris, materials, etc., at the completion of tasks.
- 3.3.8 Report any hazardous (uncontrolled) conditions to AECOM's authorized supervisor.

- 3.3.9 Understand the hazards that may be faced during live work, including arc flash, shock, or other electrical hazards.
- 3.3.10 Properly inspect prior to use, and properly use required PPE and electrical tools as specified in this work instruction and the applicable SH&E Plan.
- 3.3.11 Communicate with the authorized electrical attendant as necessary.
- 3.3.12 Alert the attendant whenever any abnormality occurs (e.g., sparking, minor shock, burning smell, etc.) or symptoms of unsafe conditions are observed.
- 3.3.13 Stop all work and exit from the approach zone whenever:
 - An order to evacuate is given by the authorized electrical attendant or the authorized supervisor; or
 - When the worker observes any warning sign or symptom of short circuiting or a dangerous situation; or
 - When the supervisor gives an order to stop work.

4.0 Multi-employer Live Electrical Work Coordination

4.1 AECOM will:

- Inform the client / owner, or if applicable, the host employer, of hazards presented by the work conducted by AECOM, hazards identified during the course of work not previously identified, and measures in place to control hazards identified by AECOM, client / owner or host employer.
- Inform the contractor that the workplace contains shock and / or arc flash potential and that live work is allowed only through compliance with a live work permit program meeting the requirements of the applicable Federal and State / Provincial legislation.
- Appraise the contractor of the elements of the work, including the hazards identified and all past experiences with the live work that make the live work hazardous.
- Appraise the contractor of any precautions or procedures that have been implemented for the protection of employees in the approach zone where contractor personnel will be working.
- Prior to work commencing, coordinate live work operations with the contractor when both AECOM employees and contractor employees will be working in or near approach zone, so that employees of AECOM and the contractor do not endanger each other.
- Debrief the contractor at the conclusion of the live work operations.

4.2 **Contractor Requirements** – In addition to complying with the live work permit requirements, each contractor who is retained to perform live electrical work will:

- Obtain any available information regarding live work from the Manager.
- Coordinate live work operations with the Manager when both AECOM personnel and contractor personnel will be jointly working in or near the approach zone.
- Practice work in accordance with Federal and State / Provincial regulations and industry best practices.
- Inform AECOM's Manager of the live work permit that the contractor will be using and of any hazards confronted or created during live work, either through debriefing or during live work.

5.0 Required Minimum Qualifications

- 5.1 All electrical work including instrumentation, installations, maintenance, troubleshooting, calibration, and operation of breakers will only be conducted by qualified, trained, and skilled personnel (this includes AECOM personnel and contractors / subcontractors). These personnel will meet all qualification requirements mandated by the Federal / State / Provincial regulations as well as applicable electrical

associations and trade bodies (e.g., NFPA 70E – refresher training in safety related practices and any changes to the NFPA standard shall be completed at intervals not exceeding three years).

- 5.2 The Manager, in consultation with the Safety, Health and Environment (SH&E) Department, will determine the minimum qualifications requirements for any work with the potential for arc flash.

6.0 Working on or Near Electrical Conductors of Circuit Parts

- 6.1 Safe work practices shall be used to safeguard employees from injury when working on or near exposed electric conductors or circuit parts that can be energized.
- Live Parts – Safe Work Conditions: Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them.
 - Live Parts – Unsafe Work Conditions: Only qualified persons shall be permitted to work on electrical conductors or circuit parts that have not been put into electrically safe conditions.
- 6.2 Working on or near exposed electrical conductors OR circuit parts that are, or might become, energized – Prior to working on or near exposed electrical conductors and circuit parts operating at 50 volts or more, lockout / tagout devices shall be applied in accordance with AECOM and site-specific policies.
- 6.3 Electrical Hazard Analysis – If the live parts operating at 50 volts or more are not placed in electrically safe condition, other safety-related work practices shall be used to protect employees who might be exposed to electrical hazards. Safe work practices mentioned below shall be established before any person approaches exposed live parts within limited approach boundary:
- 6.3.1 Shock Hazard Analysis – A shock hazard analysis shall determine the voltage to which personnel will be exposed, boundary requirements, and the PPE necessary in order to minimize the possibility of electrical shock.
- 6.3.2 Flash Hazard Analysis – A flash hazard analysis shall be done in order to protect personnel from the possibility of being injured by an arc flash. The analysis shall determine the flash protection boundary and the PPE that people within the flash protection boundary shall use.

7.0 Shock Hazard Analysis and Approach Boundaries

- 7.1 A comprehensive Shock Hazard Analysis Survey is the method used to:
- 7.1.1 Systematically analyze shock hazards,
 - 7.1.2 Identify approach boundaries, and
 - 7.1.3 Identify appropriate PPE.
- 7.2 Before permitting live work on electrical equipment, each project site having electrical equipment operating at more than 50 volts is required to conduct a Shock Hazard Analysis Survey. Upon completion of the survey, the applicable electrical areas / spaces will be labeled in accordance with survey results. As applicable, temporary barriers, or barricades, shall be installed when access to opened enclosures containing exposed energized electrical equipment is not controlled by authorized personnel.
- 7.3 Shock hazard analysis for individual equipment is not required if a facility-wide shock hazard analysis has been conducted and if conditions (including labels and signage) are maintained at all times.
- NOTE: Only authorized personnel are allowed to work within the approach boundaries.*
- 7.4 No qualified person shall approach or take any conductive object closer to exposed live parts operating at 50 volts or more than the restricted approach boundary set forth in National Fire Protection Act (NFPA) 70-E.
- 7.5 In the absence of a facility-wide survey, a Shock Hazard Analysis (including the identification of approach boundaries) shall be conducted (see Appendix A-1 of this procedure) for all electrical equipment operating at over 50 volts.
- 7.6 Results of both facility-wide as well as individual Shock Hazard Analysis Survey shall be made available to

all authorized employees, including Qualified Persons and Authorized Attendants. Additionally, any recommendations given by the survey generated from the survey shall be reviewed by the Manager and shall be addressed in a timely manner.

8.0 Arc Flash Hazard Analysis and Approach Boundaries

- 8.1 Arc flash safety requirements apply to all electrical equipment operating at 50 volts or more.
- 8.2 A comprehensive Arc Flash Hazard Analysis Survey is the method used to:
 - 8.2.1 Systematically analyze the potential for arc flash,
 - 8.2.2 Identify the limits of the approach, and
 - 8.2.3 Identify appropriate PPE (refer to appendix A-2).
- 8.3 Prior to performing any work on energized electrical systems, an Arc Flash Hazard Analysis (including the identification of approach boundaries) will be conducted and documented by a qualified person, and reviewed with affected personnel.
- 8.4 Once a comprehensive facility Arc Flash Hazard Analysis Survey has been conducted and electrical work areas / spaces are labeled in accordance with survey results, an individual Arc Flash Hazard Analysis is not required, provided that qualified personnel confirm that the conditions, as indicated on the labels and signs, are maintained.

NOTE: Only authorized personnel are allowed to work within the limits of approach.
- 8.5 Reviews of the Arc Flash Hazard Analysis shall be undertaken by a qualified person as appropriate (e.g., when changes are made to the electrical system, minimum every 5 years to confirm accuracy of labelling, etc.)
- 8.6 Please refer to NFPA 70-E for details.
- 8.7

9.0 Required PPE Categorized by Exposure

- 9.1 Employees shall be provided specialized PPE appropriate to the voltage that may be encountered.
- 9.2 The following specialized PPE requirements will be used while working on energized electrical systems. PPE appropriate to the voltage that may be encountered:
 - 9.2.1 As prescribed by the shock hazard analysis and arc flash analysis; or
 - 9.2.2 As identified in the location or project specific SH&E Plan.
- 9.3 All PPE (e.g. arc rated clothing, insulated gloves, leather covers, etc.) shall be visually inspected prior to issue, prior to each use, according to manufacturer specifications, and if suspected of damage.
- 9.4 Damaged or defective PPE shall be immediately removed from service.

10.0 Required Tools and Equipment

- 10.1 Employees shall be provided tools and testing or protective equipment approved to the applicable standard (ANSI / ASTM / CSA) for the relevant voltage rating to be used when working on energized electrical systems.
- 10.2 All tools and testing or protective equipment (e.g. sleeves, blankets, hot sticks, etc.) shall be visually inspected and tested prior to use, and as appropriate, according to regulatory requirements (e.g., as per NFPA 70E sleeves / blankets every 12 months, gloves every 6 months, etc.), according to manufacturer's specifications, specific to task (e.g., testing for absence of voltage, equipment function must be verified

using a known voltage source before and after absence of voltage test), and if suspected of damage (e.g., after an incident), to confirm that the protection systems associated with the tool or equipment are not damaged or impaired and that diagnostic meters and tools are configured properly.

- 10.3 Tested equipment shall be marked in a manner to identify either the most current test date or the next date testing is due.
- 10.4 Any tool or testing or protective equipment suspected of being compromised will be immediately taken out of service and will be tagged for disposal.

11.0 Work on Energized Electrical Systems

- 11.1 All electrical maintenance or troubleshooting will be done on de-energized circuits, to the extent practical. Work on energized circuits can only be done under special circumstances using a "Live Work Permit" issued by an authorized electrical supervisor. This permit takes into consideration the voltage levels, known electrical hazards, communication requirements, insulated tool requirements, and need for watch persons, etc. The following procedure will be observed for a live work permit:

- 11.1.1 The person requesting the work (Qualified Person) will complete the permit and will retain the original with him or her during the work. Copy of the permit will be displayed at a prominent location in the control room as a notice that live work has been authorized in certain part of the plant / project.
- 11.1.2 Permit will be reviewed for correctness, proper safety precautions, and adequacy of controls by the authorized electrical supervisor. After satisfying all safety requirements, an authorized electrical supervisor will sign the permit and will give the original copy to the Qualified Person.
- 11.1.3 Upon work completion, the Qualified Person will note any observation on the permit and will return the original to the authorized supervisor.
- 11.1.4 Authorized supervisor will keep both copies of the permit as a controlled record for a period of 12 months.

- 11.2 The following conditions will be met for live electrical work:

- 11.2.1 If a qualified person is working in the vicinity of live electrical line, including overhead lines, whether in an elevated position or on the ground, the person may not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in the below table (or as specified by the applicable jurisdiction) unless:
- The qualified person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage involved are considered to be insulation of the person from the energized part on which work is performed), or
 - The energized part is insulated both from all other conductive objects at a different potential and from the person, or
 - The person is insulated from all conductive objects at a potential different from that of the energized part.

APPROACH DISTANCES FOR QUALIFIED EMPLOYEES - ALTERNATING CURRENT

300V and less	Avoid Contact
Over 300V, not over 750V	1 ft. 0 in. (30.5 cm)
Over 750V, not over 2kV	1 ft. 6 in. (46 cm)
Over 2kV, not over 15kV	2 ft. 0 in. (61 cm)
Over 15kV, not over 37kV	3 ft. 0 in. (91 cm)
Over 37kV, not over 87.5kV	3 ft. 6 in. (107 cm)
Over 87.5kV, not over 121kV	4 ft. 0 in. (122 cm)
Over 121kV, not over 140kV	4 ft. 6 in. (137 cm)

- 11.2.2 If any equipment or instrumentation is to be disabled while other related components or systems are still functioning, the Live Work Permit should record how process safety of the remaining systems will be maintained.
- 11.2.3 All electrical and instrumentation work conducted will be recorded in the applicable MCC log. The documentation will include a reference to the permit number where appropriate.
- 11.2.4 The worker will inform the operations supervisor that he or she intends to de-energize a circuit. He or she will also inform the operations supervisor when the work is complete and that the system can be returned to service.
- 11.3 See *S3AM-302-FM1 Energized Electrical Work Permit* for a suggested template for a "Live Work Permit."

12.0 Lockout / Tagout Policy and Procedures

- 12.1 All equipment will be locked out prior to any work commencing in accordance with AECOM's procedure *S3AM-410-PR1 Hazardous Energy Control* and applicable site-specific lockout / tagout program.

13.0 Troubleshooting Procedure

- 13.1 The troubleshooting of electrical equipment often requires working with live circuits. Where possible, work will be done on de-energized circuits following the relevant AECOM and site-specific lockout / tagout policy. However, troubleshooting may require limited work on live circuits; if such work is required it will be done using the "Live Work Permit" and site-specific Troubleshooting Guidelines.

14.0 Housekeeping

- 14.1 All areas containing electrical equipment will:
 - 14.1.1 Be maintained and kept clean.
 - 14.1.2 Be well illuminated.
 - 14.1.3 Not be used for storage of supplies.
 - 14.1.4 Not be used for the storage of any flammable materials.
 - 14.1.5 Be assessed for safety hazards.
 - 14.1.6 Be suitably ventilated to control dust, temperature, and humidity.

15.0 Communication

- 15.1 Personnel working in or around equipment with electrical hazards will employ a suitable means of communication to confirm their safety.
- 15.2 The means of communication may include:
 - 15.2.1 Authorized attendant (required for ALL live work conducted on 600 volts and above).
 - 15.2.2 Permits.
 - 15.2.3 Two-way radios.

16.0 Signage and Labels

- 16.1 Motor Control Center (MCC), Electric Contact Relay (ECR) battery rooms, and electrical panels are required to have the following labeling to identify arc flash and shock hazards. The information on the label will include:

- 16.1.1 Flash Hazard Boundary (Arc Flash Current);
 - 16.1.2 Flash Hazard at 18 inches in cal / cm² or joules;
 - 16.1.3 PPE Category;
 - 16.1.4 Shock Hazards;
 - 16.1.5 Limited Approach Boundaries;
 - 16.1.6 Restricted Approach;
 - 16.1.7 Prohibited Approach; and
 - 16.1.8 Log book to record all electrically related activities.
- 16.2 All doorways to buildings and enclosures containing energized electrical equipment will be signed to indicate that:
- 16.2.1 Access is restricted to authorized personnel only; and
 - 16.2.2 Electrical hazards exist beyond this (boundary, door, etc.).

APPENDIX A-1

NFPA 70-E Approach Boundaries to Live Parts for Shock Protection

(All dimensions are distance from live part to employee.)

Nominal Voltage Range (Phase to Phase)	Limited Approach Boundary	Exposed Fixed Circuit Parts	Restricted Approach Boundary; includes inadvertent movement adder	Prohibited Approach Boundary
	Exposed Moveable Conductor			
Up to 50 Volts	Not Specified	Not Specified	Not Specified	Not Specified
50-300	10 feet	3.5 feet	Avoid Contact	Avoid Contact
300-750	10 feet	3.5 feet	1 foot	1 inch
More than 750 volts	Consult a Master Electrician, High Voltage Electrician or other authorized electrician.			

APPENDIX A-2

NFPA 70-E Protective Clothing and Personal Protective Equipment (PPE) Matrix

Protective Clothing Characteristics

PPE Category	Clothing Description (Typical number of clothing layers is given in parentheses)	Required Minimum Arc Rating of PPE [(J/cm ² (cal/cm ²)]
1	Arc rated shirt and pants or coverall (1)	16.74 (4)
2	Cotton underwear – conventional short sleeve and brief / shorts, plus FR shirt and FR pants (1 or 2)	33.47 (8)
3	Cotton underwear plus FR shirt and FR pants plus FR coverall, or cotton underwear plus two FR coveralls (2 or 3)	104.6 (25)

4	Cotton underwear plus FR shirt and FR pants plus multilayer flash suit (3 or more)	167.36 (40)
<p>NOTE:</p> <p>Arc rating: Arc rating is defined in Article 100 and can be either ATPV or E_{BT}.</p> <p>ATPV: ATPV is defined in ASTM F 1959-99 as the incident energy on a fabric or material that results in sufficient heat transfer through the fabric or material to cause the onset of a second-degree burn based on the Stoll curve.</p> <p>E_{BT}: E_{BT} is defined in ASTM F 1959-99 as the average of the five highest incident energy exposure values below the Stoll curve where the specimens do not exhibit breakopen. E_{BT} is reported when ATPV cannot be measured due to FR fabric breakopen.</p>		

Generator Safety

S3NA-302-ATT2

1.0 Objective/Overview

- 1.1 Portable generators should be used with extreme caution in order to prevent personal injury. When using a portable generator it is important to follow the manufacturer's instructions to avoid injuring someone or damaging your generator or appliances.
- 1.2 Allow only trained, authorized personnel to operate the generator. Along with training, consider the need for other safety measures, including proper maintenance of equipment and personal protective equipment (PPE). It is important to note that muscle strains are the most common injury associated with portable generators.

2.0 Safe Operating Guidelines

- 2.1 Follow manufacturer's recommended operating instructions; every generator is not the same.
- 2.2 Maintain adequate ventilation. Generators emit carbon monoxide (CO). Never operate a generator in an enclosed building without proper ventilation.
- 2.3 Turn the generator off and allow it to cool prior to re-fueling. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark.
- 2.4 Gasoline shall only be stored and dispensed to portable generators using a UL/FM approved safety can of 5 gallons (19 liters) or less. No smoking or open flames within 50 feet (15.24 meters) of the refueling area is permitted.
- 2.5 To avoid a shock, make sure that your hands are dry and that you are standing in a dry place whenever you operate the generator.
- 2.6 Turn off equipment and lights supplied by the generator until it is running.
- 2.7 Use the right extension cord. Use only UL-listed, three-prong extension cords. Be sure the extension cord is the proper size (wire-gauge) to handle the electric load that will be plugged into it.
- 2.8 Ensure the generator is properly grounded prior to each use.
- 2.9 Using a portable generator to tie into the wiring of an existing structure shall be done only by a licensed electrician.
 - 2.9.1 Potential Hazards include:
 - Lifting, carrying, and pulling starter cords;
 - Burns from contact with the hot muffler or engine;
 - Shocks/electrocution;
 - Noise exposure; and
 - Inhaling exhaust gases, CO.
 - 2.9.2 Training Requirements include:
 - Review of applicable standard operating procedures;
 - Back Injury Prevention;
 - Demonstrated knowledge on the use of a generator; and
 - Review of manufacturers operating guidelines.

2.9.3 Level D PPE include:

- Leather Gloves;
- Hearing Protection; and
- FR or non-synthetic clothing when a fire hazard is present.

2.9.4 Other Safety Tips include:

- Have a Class A:B:C fire extinguisher readily available at all times.

Excavation

S3AM-303-PR1

1.0 Purpose and Scope

- 1.1 To evaluate all excavation operations to provide proper protective systems for employee protection from associated hazards.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Benching (Benching system)** – One or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels to protect employee from cave-ins.
- 2.2 **Cave-in (collapse)** – The separation of a mass of soil or rock material from the side of an excavation or the loss of soil from under a trench shield or support system and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.
- 2.3 **Competent person** – Person, who, by way of training, knowledge, and/or experience, is capable of classifying soils and is also capable of identifying existing and predictable hazards in excavation/trenching work area and who has the authority to take prompt corrective measures to eliminate them. The person shall also be familiar with the requirements in the regulation.
- 2.4 **Excavation** – A manmade cut, cavity, trench, or depression in an earth surface formed by earth removal. Examples include trenches, tunnels, shafts, caissons and open cut holes.
- 2.5 **Faces (or sides)** – The vertical or inclined earth surfaces formed as a result of excavation work.
- 2.6 **Failure** – A structural member's integrity and supportive capabilities is compromised, causing a breakage, displacement, or permanent deformation.
- 2.7 **Hazardous Atmosphere** – An atmosphere that by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen-deficient, toxic, or otherwise harmful may cause death, illness, or injury.
- 2.8 **Protective Systems** – Devices or methods in protecting employees in an excavation from cave-ins, a collapse or falling material. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.
- 2.9 **Ramp** – An inclined walking or working surface that is used to gain access to one point from another and is constructed from earth or from structural materials such as steel or wood.
- 2.10 **Professional Engineer** – A registered engineer who can authorize any state of work by his professional designation. A **Professional Engineer** registered in the State, Province, or territory is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.
- 2.11 **Shield (Shield system)** – A structure that is able to withstand the forces imposed on it by a cave-in and thereby protects employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."
- 2.12 **Shoring (Shoring system)** – A structure such as a metal hydraulic, mechanical, or timber shoring system that supports the sides of an excavation and that is designed to prevent cave-ins.

- 2.13 **Sloping (Sloping system)** – An alternative to shoring is trench sloping. This means that the trench walls are cut back to decrease the possibility of cave-ins. The angle of incline required to prevent a cave-in varies with such factors as soil type, environmental conditions of exposure, and application of surcharge loads.
- 2.14 **Stable rock** – A natural solid mineral material that can be excavated with vertical side wall; unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against cave-in or movement by rock bolts or by another protective system that has been designed by a **Professional Engineer**.
- 2.15 **Support system** – A structure such as underpinning, bracing, or shoring that provides support to an adjacent structure, underground installation, or the sides of an excavation.
- 2.16 **Trench** – An open narrow excavation made below the surface of the ground. In general, the depth is greater than the width, but the width (measured at the bottom) is often not greater than 15 feet (4.57 meters). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.57 meters) or less (measured at the bottom of the excavation), the excavation is also considered a trench.
- 2.17 **Trench Box** – A trench box is a unit of shoring that is an engineered shoring system capable of protecting workers in case of cave-in of trench walls. The space between the trench wall and the trench box shall be backfilled.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-202-PR1 Competent Person Designation
- 3.3 S3AM-218-PR1 Permit to Work
- 3.4 S3AM-322-PR1 Overhead Lines
- 3.5 S3AM-331-PR1 Underground Utilities

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Managers

- Shall confirm that all projects under their direct control or authority and which involve excavations or trenching are conducted in a safe and efficient manner and in accordance with the requirements of this procedure and local legislation.
- Shall confirm that all projects under their direct control or authority have a written Safe Work Plan (SWP)/Health and Safety Plan (HASP) prepared for the activity.
- Confirm the applicable *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* or equivalent has been completed and is reviewed prior to commencing any excavation activities.

4.1.2 Professional Engineer

- The professional status and the actual practice of professional engineering is legally defined and protected by law. In some jurisdictions, only licensed engineers (sometimes called registered engineers) are permitted to "practice engineering."
- For the purposes of this procedure, determination of soil condition and the safe management of the shoring, sloping or benching may require consultation, specifications and/or design by a Professional Engineer.

4.1.3 Competent Person

- Shall be present during all work that involves entry by AECOM personnel into trenches or excavations greater than 5 feet (1.52 meters) in depth (as above).
- Does not have to be an AECOM employee; however, an AECOM competent person shall be qualified per *S3AM-202-PR1 Competent Person Designation*.
- Shall identify prompt corrective measures to eliminate recognized present or anticipated hazards.
- The competent person shall be identified in the SH&E Plan for the location or project, and the Task Hazard Assessment for the particular task.
- The competent person:
 - Will determine the maximum allowable slope for the walls of the trench or excavation.
 - Will classify the soil in the trench or excavation in accordance with the requirements specified in the applicable legislation prior to determining that a maximum allowable slope, other than 34 degrees with the horizontal is selected.
 - Will inspect the excavation or trench on a daily basis when the potential for employee exposure to the hazards of the trench or excavation exists (*S3AM-303-FM1 Daily Excavation Checklist*).

4.1.4 Employees

- Maintain appropriate training for the excavation and the applicable tasks, and competency in the associated procedures (e.g. communication, rescue, etc.) and use of the necessary personal protective equipment (PPE). Refer to *S3AM-003-PR1 SH&E Training* and *S3AM-208-PR1 Personal Protective Equipment*.
- Know the location specific Emergency Response Plan and be able to recognize the potential for real hazards associated with the Excavation.
- Refrain from making any attempt to enter an excavation without approval and first meeting the requirements of this procedure and the applicable SH&E Plan (SWP)/Health and Task Hazard Assessment (THA).

4.2 Restrictions

- 4.2.1 Because of their inherent dangers, entry into trenches and excavations shall not be performed if there are means other than entry to perform the work. Where entry into trenches and excavations is necessary, strict adherence to the procedures specified below is extremely important. Whenever there are questions regarding the safety of trench or excavation entry, contact shall be made with the Competent Person or the SH&E Manager.
- 4.2.2 No one shall enter any trench or excavation until the walls have been adequately cut back or temporary protective structures have been installed unless the trench or excavation is shallower than stabilized.
- 4.2.3 Excavation work shall be completed and inspected in accordance with the written instructions of a qualified professional and in accordance with jurisdictional legislative regulations.

4.3 Excavation and Trenching Permit

- 4.3.1 If required by the applicable jurisdiction, confirm notification of the proposed excavation is provided within the required timeframe to the appropriate agencies or governing bodies prior to commencing excavation (e.g. California – CAL/ASHA Excavation Permit for the construction of trenches or excavations that are 5 feet (1.5 meters) or deeper that will be entered; Manitoba WHS Branch notification in order to obtain registration number, etc.).
- 4.3.2 An Excavation and Trenching Permit (*S3AM-303-FM2 Excavation & Trenching Permit* or equivalent) shall be completed prior to all excavation or trenching activities
- 4.3.3 The Excavation and Trenching Permit shall be completed and signed by all applicable parties as indicated on the permit. The Project Manager shall determine which signatures are required.

- 4.3.4 Excavation and Trenching Permits may be valid for up to one week; however the permit shall be reviewed at the beginning of each shift.
- 4.3.5 Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
- 4.4 Planning and Preparation
 - 4.4.1 Prior to beginning any excavation work at a site, the location of all underground and overhead utilities shall be identified and work locations will be carefully planned to avoid any potential for inadvertent contact with them.
 - 4.4.2 Clearance, including hand exposure, of underground utilities shall be completed in accordance with *S3AM-331-PR1 Underground Utilities*. The associated *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* or equivalent shall be available and reviewed with all employees expected to be involved in the excavation prior to commencing any excavation activities.
 - 4.4.3 Identify any overhead power lines and de-energize or protect by other appropriate means. Refer to *S3AM-322-PR1 Overhead Lines*.
- 4.5 Excavation Requirements
 - 4.5.1 A Professional Engineer shall be engaged if specified by the applicable jurisdiction and as appropriate to the soil conditions and proposed excavation considerations (e.g. wall slope, shoring requirements, load calculations, etc.).
 - 4.5.2 All personnel involved in the excavation activities shall be appropriately trained to their respective activities and associated hazards. Refer to *S3AM-003-PR1 SH&E Training*.
 - 4.5.3 All personnel involved in the excavation activities shall wear the required PPE, including reflective clothing if mobile equipment or vehicular traffic. Refer to *S3AM-208-PR1 Personal Protective Equipment*.
 - 4.5.4 The Task Hazard Assessment (THA) or Safe Work Plan (SWP) identifying applicable hazards and appropriate control measures shall be completed and clearly communicated to all involved personnel as well as to any concurrent operations potentially affected. The work environment shall be monitored for changing conditions and the THA / SWP updated accordingly.
 - 4.5.5 Excavation shall be conducted in a manner that minimizes environmental impact.
 - 4.5.6 Excavated (spoil) material shall be kept at least 3.2 feet (1 meter) from the edge of the excavation, or further if local regulations are more stringent.
 - Excavated (spoil) material shall be piled in a manner to prevent sloughing of loose material. Various jurisdictions provide specific spoil pile sloping requirements.
 - 4.5.7 If the walls of an excavation or trench are not sloped or cutback, barriers shall be placed around the perimeter. The barrier shall be at least 3.6 feet (1.10 meters) in height.
 - 4.5.8 If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored regularly to confirm proper operation.
 - 4.5.9 If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require regular inspections.
 - 4.5.10 All excavations shall be appropriately secured at the end of the day to prevent unauthorized entry or inadvertent entry into the excavation. This may require a protective covering, barriers, fencing, signage or other measures appropriate to the excavation and associated conditions.
 - 4.5.11 Backfill trenches as soon as reasonably possible after work is complete.
- 4.6 Soils Classifications

- 4.6.1 Soil classification shall be conducted to confirm appropriate measures are taken to protect workers and to secure excavation walls. Measures may include, but are not limited to:
 - Sloping, shoring or shielding.
 - Relocation of equipment or materials.
 - Scheduling to minimize concurrent operations.
- 4.6.2 Soil characteristics evaluated when classifying include, but are not limited to:
 - Cohesiveness / compaction / compressive strengths (e.g. fissured, hardpan, fractured rock, etc.).
 - Composition (sand, clay, gravel, layered, etc.).
 - Moisture content / submersion.
 - Compaction.
 - Exposure to vibration (e.g. traffic, pile driving, etc.).
 - Previous disturbances.
- 4.6.3 Consult the applicable jurisdictional requirements as classification methods, definitions and terms can vary. In general classifications or types include:
 - Stable soil that is dense and heavy and consists primarily of clay.
 - Soil with a medium level of stability and generally includes soils such as silt, sandy loam, and medium clay.
 - Unstable soil which generally includes gravel, loamy sand, and soft clay.
- 4.7 Protective System Requirements
 - 4.7.1 Protective systems shall be used to protect workers entering an excavation when there is a potential for cave in, and is required when:
 - An excavation is greater than 4 feet (1.22 meters) in depth and is not entirely in stable rock.
 - A worker is required to be closer to a trench wall than the height of the trench wall.
 - A worker will approach closer to the side or edge of the excavation that the distance equal to the depth of the excavation.
 - 4.7.2 The protective system may include sloping the excavation walls, shoring the excavation walls, and/or installing a shielding system. The protective system(s) chosen shall have the capacity to resist, without failure, all loads to be applied to the system.
 - 4.7.3 Slope angle, or type of shoring or shielding shall be determined by:
 - Soil classification – including structure, strength, moisture content.
 - Depth of the excavation
 - Weather and environmental conditions.
 - Anticipated duration of excavation activities.
 - Loading of soil and soil stress (e.g. proximity of structures, location of equipment, stored material, anticipated vibration, etc.)

Factor	Description / Examples
Soil Structure and Strength	Proper classification of soil is necessary in order to select appropriate protection methods. Trench walls, at first glance, may appear to have strength, particularly if rock is encountered. Fractures in the rock can develop because of construction and soil strength may fail when subjected to undercutting or high-energy impacts. Irregular slopes on stratified soils that appear stable can fail if lower materials do not have adequate strength.
Excavation Depth	Jurisdictional requirements may specify the type of protective methods that are required at given depths. Additionally, consultation of a professional engineer may be necessary.
Soil Moisture Content	Soil may be moist even though the weather has been dry. Care shall be taken and appropriate protection methods employed if the soil appears to be moist.
Weather and Humidity	These can have a significant impact on excavation wall stability and effectiveness of protection methods. Frozen stable soil may collapse if warm mild weather persists. Percolation of water into the soil can increase the load on shoring due to the increased weight and mobility of saturated soils. Frozen ground does not preclude the need to appropriately slope, shore or shield unless the freezing process is designed and approved by a Professional Engineer.
Loading and Soil Stress	Stress can originate from many sources. Heavy machinery passing close to the excavation creates vibrations that decrease the soil strength and can result in wall collapse or shoring failure if it is inadequate to these conditions. Stationary equipment at the edges of the excavation can transmit loads and additional stresses to the excavation wall and method of protection.
Trench Depth and Width	These directly influence the choice of materials and the spacing of support bracing. The shoring requirements of a wide and deep trench differ substantially from those of a narrower trench.
Erosion Time	If excavations are to be left for extended periods, different methods of protection may be required and shoring materials may have to be increased.

- 4.7.4 If an excavation may affect the stability of an adjacent building or structure, precautions shall be taken to prevent damage to the structure. The precautions shall be specified in writing by a Professional Engineer.
- 4.7.5 All sloping, shielding, or shoring shall be conducted in accordance with applicable Federal, State, Provincial, Territorial or Legislative regulations.
- 4.7.6 Exceptions. Each individual in an excavation shall be protected from cave-ins and trench collapse by an adequate protective system except when:
- Excavations are made entirely in stable rock.
 - Excavations are less than 4 feet (1.22 meters) in depth and an examination of the excavation by a Competent Person reveals no indication of a potential cave-in.
- 4.7.7 The depth of the excavation or trench is to be measured at its greatest vertical dimension. Be aware that crouching or kneeling in a trench that is less than 3 feet (0.91 meter) in depth may still pose significant hazard for the employee involved.
- 4.7.8 Consult the applicable jurisdiction's requirements concerning the standards that protective systems shall meet; this may include design and certification by a Professional Engineer.
- 4.7.9 A Professional Engineer can properly assess the need for and the type of shoring required for specific applications. Shoring may not be needed in all cases, but failure to recognize the need for shoring can be catastrophic.
- 4.8 Use of Sloping as a Means of Protection
- 4.8.1 Sloping the walls of the trench or excavation is the preferred, and typically simplest, means of protecting employees who shall enter trenches or excavations which are greater than 4 feet (1.22 meters) in depth or where there is danger of collapse.
- 4.8.2 If sloping is used as the means of protection, the trench or excavation walls shall be sloped back so that the ratio of the horizontal distance to the vertical rise (H:V ratio) of the sloped wall or degree from horizontal is appropriate to the soil type and in compliance with jurisdictional requirements.
- 4.8.3 In many cases, determining the maximum allowable slope may allow the use of a steeper slope, which will result in a narrower excavation. However, determination of soil classification is complicated and requires that the Competent Person be familiar with the manual and visual tests. Since incorrect soil classification may result in the use of a steeper, and potentially unsafe, slope, it

is recommended that an angle of 34 degrees (or less given specific jurisdictional requirements and unstable soil types) with the horizontal typically be selected.

4.9 Use of Shoring or Shielding as a Means of Protection

- 4.9.1 Where sloping the walls of the trench or excavation is unfeasible (e.g., when there are dimensional constraints or adjacent structures), the use of shoring or shield systems (e.g., trench boxes) may be necessary.
- 4.9.2 Soil classification is required. The excavation shall comply with one of the four options below:
 - The soil shall be classified and the timber shoring be constructed in accordance with applicable legislative regulations.
 - Other protective systems meeting applicable legislative regulations shall be utilized (e.g., shield systems, trench jacks, aluminum hydraulic shoring, etc.) and the manufacturer's data shall be explicitly followed.
 - A protective system meeting applicable legislative regulations shall be utilized based on tabulated data which has been approved by a Professional Engineer.
 - A protective system meeting applicable jurisdictional requirements and designed by a Professional Engineer shall be utilized and installed in accordance with the engineer's written plans.
- 4.9.3 In all cases listed above, the SH&E Manager shall be contacted before proceeding.
- 4.9.4 Workers shall be protected whenever shoring is being installed or removed.
- 4.9.5 Shoring, stringers or bracing shall be installed from the top of the trench or excavation down. Removal shall be completed from the bottom up unless conditions exist that would make doing so unsafe. A removal method shall be developed that does not require worker entry.
- 4.9.6 Check hydraulic shoring once per shift at a minimum (leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, other damaged or defective parts) and more frequently as required.
- 4.9.7 Hydraulic or pneumatic trench jacks shall have a means of ensuring that they will not collapse in the event of loss of internal pressure.
- 4.9.8 Shielding and Trench Boxes differ from shoring in that their design is intended primarily to protect workers from cave-ins and similar incidents. They may be used in combination with sloping and benching.
 - The excavated area between the outside of the trench box and the face of the trench should be as small as possible and may be backfilled to prevent lateral movement of the shield.
 - The box shall extend at least 18 inches (0.45m) above the surrounding area, or as specified by the applicable jurisdiction, if there is sloping toward excavation. This can be accomplished by providing a benched area adjacent to the box.
 - Earth excavation below the shield is permitted only if:
 - The excavation does not exceed a depth of 2ft (0.61m) below the shield,
 - The shield is capable of withstanding the forces calculated for the full depth of the trench, and
 - There are no indications while the trench is open of possible loss of soil from behind or below the bottom of the support system.
 - A shield shall not be subjected to loads exceeding those for which it was designed to withstand.
- 4.9.9 Bell-bottom pier holes that are to be entered by workers shall be designed and supported according to written instructions of a registered professional engineer.

- Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, should wear a harness with a retrieval line securely attached to it.
 - Retrieval lines shall not be used to handle materials.
 - Rescue equipment shall be individually attended at all times while the employee wearing the retrieval line is in the excavation.

4.10 Work Around the Trench/Excavation

- 4.10.1 Structural ramps used for excavation access or egress of equipment shall be constructed in accordance with jurisdictional requirements and the instructions or designs of an individual competent and qualified in structural design.
- 4.10.2 If the ramp has an open side, it shall have a curb or a restraining device.
- 4.10.3 Confirm equipment placement does not compromise the integrity of the excavation wall and optimizes visibility of work zone and any contact hazards (spoil placement should also take these into consideration). Use wheel chocking or barricades as necessary to prevent encroachment of edge.
- 4.10.4 If the appropriate setback of equipment is not possible confirm appropriate blocking or matting is used to disperse weight. These requirements may need to be determined by a professional engineer.
- 4.10.5 While workers are in a trench, an aboveground observer or spotter shall be present to warn of earth movements and to advise equipment operators of the presence and location of those in the trench so as to avoid vibrating equipment near trenches or excavations.
- 4.10.6 If there is a danger of a worker or equipment falling into an excavation, or whenever the edge is not clearly visible, identify the trench or excavation perimeter with visual markers (e.g., barricade tape, wooden railings, stop logs, etc). If the trench or excavation is 4 feet (1.22 meters) or greater in depth, the visual barrier shall be a minimum of 6 feet (1.83 meters) from the edge.
- 4.10.7 Personnel shall notify workers of the excavation through flagging, marking, safeguards, or other appropriate and effective means.
- 4.10.8 If walkways are permitted over excavations or trenches (e.g. trench over 6 feet [1.8 meters] in depth and wider than 30 inches [76 centimeters]), the installation shall be in such a manner as to not compromise the stability of the excavation.
- 4.10.9 Walkways shall be equipped with guardrails and constructed in accordance with jurisdictional requirements.
- 4.10.10 If vehicle crossings over excavations are required, they shall be designed by and installed under the direction of a Professional Engineer.
- 4.10.11 Precautions shall be taken to isolate or remove loose rocks, trees, or other materials that may slide, roll, or fall into the trench and onto workers prior to entry by workers into an excavation.
- 4.10.12 While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated signal person through either direct voice contact or approved standard hand signals.
- 4.10.13 When mobile equipment is operated adjacent to an excavation or when such equipment is required to approach the edge of an excavation and the operator does not have a clear and direct view of the edge of the excavation, a warning system such as barricades, hand or mechanical signals, or stop logs shall be used. If possible, the grade should be away from the excavation.
- 4.10.14 All site personnel should maintain a safe distance and remain clear of the swing of operating excavation equipment.
- 4.10.15 Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles

being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.

4.10.16 All materials such as pipe, rebar, etc., shall be kept out of traffic lanes and access ways. Materials and equipment shall be stored in a designated area so as not to endanger personnel at any time.

4.10.17 A flagman with roadwork, signs, cones, and high-level warning signs shall be provided when it is necessary to control normal vehicular traffic due to vehicles, such as end-dumps, entering, or leaving the site.

4.11 Work Within the Trench/Excavation

4.11.1 Personnel shall not be permitted on the faces of sloped or benched excavations at levels above other workers unless those workers at lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

4.11.2 Employees shall not work in excavations in which there is accumulated water or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and retrieval line.

4.11.3 A stairway, ladder, ramp, or other safe means of egress shall be located in excavations or trenches that are 4 feet (1.22 meters) or more in depth so as to minimize lateral travel for employees. Jurisdictional maximum lateral travel distances vary between 25 feet (7.6 meters) and 49 feet (15 meters). In the absence of jurisdictional specification, travel distance shall not exceed 25 feet (7.6 meters). Ladders should extend at least 3 feet (0.91 meters) above the trench top.

4.11.4 Structural ramps that are used solely by employees as a means of access or egress from excavations shall be designed by a competent person. Structural ramps used for access or egress of equipment shall be designed by a competent person qualified in structural design and shall be constructed in accordance with the design.

4.11.5 Ramps and runways constructed of two or more structural members shall have the structural members connected together to prevent displacement. Structural members used for ramps and runways shall be of uniform thickness. Cleats or other appropriate means used to connect runway structural members shall be attached to the bottom of the runway or shall be attached in a manner to prevent tripping. Structural ramps used in lieu of steps shall be provided with cleats or other surface treatments on the top surface to prevent slipping.

4.12 Confined Spaces and Hazardous Atmospheres

4.12.1 An excavation may contain hazardous gases, vapors, dusts, fumes or an oxygen deficient or enriched atmosphere.

- To prevent exposure to harmful levels of atmospheric contaminants, the hazard assessment shall evaluate atmospheric hazards when workers are required to enter trenches and excavations:
 - Greater than 4 feet (1.22 meters) in depth in which a hazardous atmosphere exists, or could reasonably be expected to exist, such as in excavations in landfill areas, where equipment is exhausting nearby, or where hazardous substances are stored nearby.
 - Less than 4 feet (1.22 meters) in depth if workers could be exposed to a hazardous atmosphere (e.g. crouching).
- Appropriate atmospheric testing is necessary to accurately identify these hazards. Ongoing atmospheric monitoring, use of attendants and rescue equipment may be necessary to address the identified hazards.

4.12.2 Confined spaces may exist in excavations where there is limited access or egress and in which a hazardous gas, vapor, dust, or fume or an oxygen-deficient atmosphere may occur. Confined

space entry shall be performed in accordance with the requirements specified in *S3AM-301-PR1 Confined Spaces*. Consult the applicable jurisdictional requirements as the excavation may or may not be subject to confined space requirements.

- 4.12.3 Adequate precautions, such as mechanical ventilation or appropriate respiratory protection, shall be taken prior to entry into trenches and excavations in which hazardous atmospheres exist or could reasonably be expected to exist.
- 4.12.4 When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to confirm that the atmosphere remains safe. Atmospheric testing will be conducted in the anticipated breathing zone of the work area to determine oxygen content, combustible gas, and toxic gases and vapors, if applicable.
- 4.12.5 Appropriate respiratory protection shall be donned prior to entry into any trench or excavation in which airborne levels of toxic substances are present at concentrations in excess of their Threshold Limit Value/Occupational Exposure Limit or Permissible Exposure Limit.
- 4.12.6 Confirm appropriate emergency response measures are in place as necessary, including but not limited to:
 - Location Specific Emergency Response Plan shall include procedures applicable to the potential emergencies the excavation work may present.
 - Communication methods shall be established.
 - Equipment such as spill kits, breathing apparatus, and retrieval equipment, shall be readily available.
 - Where hazardous atmospheres are present rescue equipment shall be attended when workers have entered the excavation.
- 4.13 **Stability of Adjacent Structures**
 - 4.13.1 Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to confirm the stability of such structures for the protection of employees.
 - 4.13.2 Excavation below the level of the base or footing of any foundation or retaining wall that could reasonably be expected to pose a hazard to employees shall not be permitted except when:
 - A support system, such as underpinning, is provided to confirm the safety of employees and the stability of the structure; or
 - The excavation is in stable rock; or
 - A Professional Engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or
 - A Professional Engineer has approved the determination that such excavation work will not pose a hazard to employees.
 - 4.13.3 In addition, sidewalks, pavements, and secondary structures shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.
- 4.14 **Inspections**
 - 4.14.1 Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a Competent Person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. Refer to *S3AM-303-FM1 Daily Excavation Checklist*.
 - 4.14.2 An inspection shall be conducted by the Competent Person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-

increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

- 4.14.3 Where the Competent Person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to confirm their safety and the permit reissued or revised.

4.15 Backfilling

- 4.15.1 Perform any required notifications within the necessary timeframes prior to backfilling.
- 4.15.2 Confirm accurate classification of soil types of backfill material and absence of signs of contamination, discoloration and smell.
- 4.15.3 Confirm the re-establishment of the original soil integrity using the original material (if suitable) or designated fill material(s). A small cap of material on top of the ditch/hole should be left to allow for sloughing and settling of material.
- 4.15.4 Backfilling shall be done with care to prevent damage to any exposed utilities or facilities.
- 4.15.5 A spotter may be necessary to avoid encroachment (e.g. working around other equipment, traveling under overhead lines, working in close conjunction to underground facilities and other workers, compromised line of vision) and to watch for any rocks falling into the excavation, which may damage exposed facilities. If fill contains rocks or hard material, a shield or alternate fill material may be used to protect the facilities
- 4.15.6 Confirm piping or facilities are properly supported prior to backfilling.
- 4.15.7 If shoring was used, remove from the bottom up.
- 4.15.8 If a trench box has been used it should be placed no more than 24" above the base of the excavation or a sub-trench bed containing the pipe.
- 4.15.9 Appropriate measures shall be taken to confirm proper backfilling and compaction of the soil below the trench box. Removing and reinserting the trench box multiple times may be necessary to accomplish this.
- 4.15.10 Dragging of a trench box shall only be permitted if it will not damage facility or disturb the backfill, otherwise it shall be lifted vertically. No worker shall occupy a trench box while it is being moved.
- 4.15.11 If compaction is required confirm the appropriate method is employed and compaction testing is conducted in a manner that does not damage any facilities or pipelines in the excavation.
- 4.15.12 Final grading and cover of the ground disturbance should confirm corrosion control. Original state of the area and access shall be considered in completion of backfilling.
- 4.15.13 Any excess excavation material shall be properly disposed of.

5.0 Records

- 5.1 Completed Daily Excavation Checklist, Permits and applicable notifications shall be retained in the project files for +1 year.

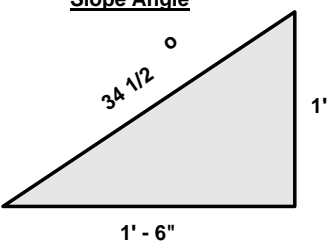
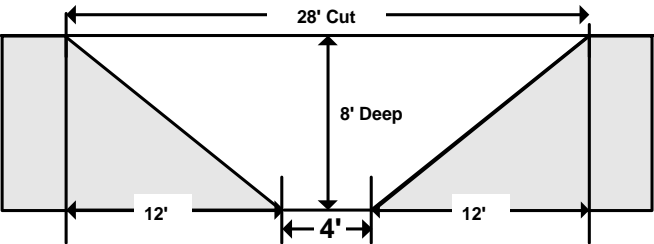
6.0 Attachments

- 6.1 [S3AM-303-FM1 Daily Excavation Checklist](#)
- 6.2 [S3AM-303-FM2 Excavation & Trenching Permit](#)

Americas

Daily Excavation Checklist

S3NA-303-FM1

Daily Excavation Checklist			
Competent Person Name:		Date:	
Competent Person Signature:			
Site Location:		Project Number:	
Soil Type:	Excavation Depth:	Excavation Width:	
Type of Protective System Used:			
Indicate for each item: Yes – No – or N/A for not applicable:			
1. General Information:	Yes	No	N/A
a. Is there a potential for a cave-in? *IF YES, excavation must be sloped, shored, or shielded.			
b. Is excavation deeper than (enter jurisdictional requirement)? * IF YES, excavation must be sloped, shored, or shielded.			
c. Is sloping used as your protective system?			
<p><u>Slope information to keep in mind:</u></p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p><u>Slope Angle</u></p>  </div> <div style="text-align: center;">  <p>Example of a Simple 34-degree Slope commonly used around the site for cave-in protection.</p> </div> </div>			
d. Was a manual method utilized to determine Soil Classification? Type			
e. Was a visual method utilized to determine Soil Classification?			
Soil classification comments:			

2. Training:	Yes	No	N/A
a. Have all individuals had Excavation Safety Awareness Training?			
b. Have all individuals reviewed the site specific Emergency Response Plan?			
3. Inspection of Job Site	Yes	No	N/A
a. Are excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work?			
b. Does the competent person has the authority to remove all individuals from the excavation immediately?			
c. Are surface encumbrances removed or supported?			
d. Are all individuals protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation?			
e. Are hard hats, safety-toed boots, and safety glasses worn by all individuals?			
f. Is spoil pile set back at least 3.2 feet (1.0 m) from the edge of the excavation and sloped to prevent sloughing and according to jurisdictional requirements?			
g. Are adequate barriers provided at all excavations, wells, pits, shafts, etc.?			
h. Are warning vests or other highly visible clothing provided and worn by all individuals?			
i. Are all individuals required to stand away from vehicles being loaded / unloaded?			
j. Are warning system established and utilized when mobile equipment is operating near the edge of the excavation (e.g., barricade tape, signalpersons, stop logs, etc)?			
k. Are all individuals prohibited from going under suspended loads?			
l. Are materials and equipment set back 3.2 feet (1.0 m) or greater from the edge of the excavation?			
4. Utilities	Yes	No	N/A
a. Are locations of utilities marked. <i>S3NA-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist</i> available and reviewed?			
b. Prior to the use of equipment, have underground utilities been located by hand exposure?			
c. Are underground utilities protected, supported, or removed when excavation is open?			
d. Are overhead lines are de-energized or protected by other appropriate means?			
5. Means of Access and Egress:	Yes	No	N/A
a. Is travel distance to means of egress no greater than (enter jurisdictional requirement) in excavations 4 feet (1.2m) or more in depth?			
b. Do straight ladders used in excavations extend at least 3 feet (0.9m) above the edge of the trench?			
c. Have ramps being used for employee access been designed by the competent person?			
d. Are all individuals are protected from cave-ins when entering / exiting the excavation?			
Protection description:			

6. Wet Conditions:	Yes	No	N/A
a. Have precautions been taken to protect workers from the accumulation of water?			
b. Is water removal equipment monitored by a competent person?			
c. Is surface water or runoff diverted or controlled to prevent accumulation in the excavation?			
d. Have inspections have been conducted after every rainstorm or other hazard-increasing occurrence (freeze/thaw, local demolition, rerouting of traffic, etc)?			
7. Hazardous Atmosphere: The atmosphere within the excavation must be tested where there is a reasonable possibility of an oxygen deficiency or a combustible or other harmful contaminant exposing any individual to a hazard.	Yes	No	N/A
a. Are there exposed sewer or natural gas lines in excavation?			
b. Is equipment operating nearby that may produce introduce exhaust into the excavation?			
c. Is the excavation near a landfill area, or are hazardous substances being stored close to the excavation?			
If you answered YES to A,B, or C then treat the excavation as a confined space. See S3NA-301-PR1 Confined Spaces			
d. Has an emergency rescue plan been developed and are rescue services in place?			
8. Support Systems:	Yes	No	N/A
a. Are materials and/or equipment for support systems selected based on soil analysis, trench depth, and expected loads?			
b. Have materials and equipment used for protective systems been inspected and are they in good condition?			
c. Have materials and equipment in unsatisfactory condition have been removed from service?			
d. Are protective systems installed without exposing all individuals to the hazards of cave-ins, collapses, or the threat of being struck by materials or equipment?			
e. Are members of support system securely fastened to prevent failure?			
f. Are support systems provided to ensure stability of adjacent structures, buildings, roadways, sidewalks, walls, etc.?			
g. Have excavations below the level of the base of a footing been approved by a registered Professional Engineer?			
h. Does removal of support systems progress from the bottom, and are members released slowly to allow for detection of any indications of possible failure?			
i. Does backfilling progress with the removal of the support system?			
j. Is material excavated to a level no greater than 2 feet (0.6m) below the bottom of the support system and only if the system is designed to support the loads calculated for the full depth?			
k. Has a shield system been placed to prevent lateral movement?			
l. Are all individuals prohibited from remaining in the shield system during movement?			

Americas

Excavation & Trenching Permit

S3NA-303-FM2

Authorization No.: _____ Date & Time Permit Valid: _____
 Competent Person: _____ Date & Time Permit Expires: _____
 Project Name: _____ Excavation/Trench Location: _____
 Description or Job Special Procedures: _____

ESTIMATED DIMENSIONS:	DEPTH = _____		
	TOP =	W _____	L _____
	BOTTOM =	W _____	L _____
SOIL ANALYSIS METHOD(S) USED: <input type="checkbox"/> Visual <input type="checkbox"/> Manual <input type="checkbox"/> Tabulated Data			
SOIL CHARACTERISTICS: <input type="checkbox"/> Cemented <input type="checkbox"/> Cohesive <input type="checkbox"/> Layered <input type="checkbox"/> Fissured <input type="checkbox"/> Granular <input type="checkbox"/> Plastic <input type="checkbox"/> Dry <input type="checkbox"/> Moist <input type="checkbox"/> Saturated <input type="checkbox"/> Submerged			
PROTECTIVE SYSTEMS: <input type="checkbox"/> Prof. Engineered Protective System Required			
SLOPING/BENCHING: <input type="checkbox"/> Vertical (90°) <input type="checkbox"/> 3/4 :1 (53°) <input type="checkbox"/> 1:1 (45°) <input type="checkbox"/> 1 1/2:1 (34°) <input type="checkbox"/> 2:1 (26°) <input type="checkbox"/> Other			
SHORING: <input type="checkbox"/> Timber <input type="checkbox"/> Trench Shield/Trench Box <input type="checkbox"/> Aluminum Hydraulic			
OTHER: <input type="checkbox"/> Means of Egress Required <input type="checkbox"/> Confined Space Permit Required <input type="checkbox"/> Mechanical Ventilation Required <input type="checkbox"/> Owner / Designate Required to be Present <input type="checkbox"/> Surveys, drawings, Plot Plans, etc. Attached <input type="checkbox"/> Landowner Consent Obtained <input type="checkbox"/> Other			
SOIL TYPE: <input type="checkbox"/> Stable Rock <input type="checkbox"/> Type A <input type="checkbox"/> Type B <input type="checkbox"/> Type C <input type="checkbox"/> Avg. Compression Strength _____ tsf <input type="checkbox"/> Compressed Strength Data _____			
MANUAL TEST USED: <input type="checkbox"/> Plasticity <input type="checkbox"/> Dry Strength <input type="checkbox"/> Ribbon <input type="checkbox"/> Thumb Penetration <input type="checkbox"/> Pocket Penetrometer <input type="checkbox"/> Dry Testing <input type="checkbox"/> Other			
UTILITIES (underground/overhead): <input type="checkbox"/> One Call Service Notified <input type="checkbox"/> Search Zone Established <input type="checkbox"/> Utilities Marked by Public Utilities Locator <input type="checkbox"/> Property Owner Contacted <input type="checkbox"/> Utility Drawings Reviewed <input type="checkbox"/> Utilities Marked by Private Locator			
LIST OF KNOWN OBSTRUCTIONS: <input type="checkbox"/> Electrical <input type="checkbox"/> Telephone <input type="checkbox"/> Water <input type="checkbox"/> Sewer <input type="checkbox"/> Steam <input type="checkbox"/> Natural Gas <input type="checkbox"/> Drain <input type="checkbox"/> Process <input type="checkbox"/> Alarm <input type="checkbox"/> Concrete Encasement <input type="checkbox"/> Pilings <input type="checkbox"/> Footings <input type="checkbox"/> Other			
UTILITIES (hand exposure requirements): <input type="checkbox"/> Radius Established – <input type="checkbox"/> Exposure Interval Established – <input type="checkbox"/> Other			
SPECIAL INSTRUCTIONS and WORK INSTRUCTIONS 			

All unsafe conditions shall be corrected prior to excavation entry. If any hazardous conditions are observed, the excavation shall be evacuated immediately, and no one is permitted to re-enter until corrective action has been taken.

Signature and Dates
(Manager shall determine which signatures are required)

	Print Name	Signature	Date
Excavation Competent Person (Required)	_____	_____	_____
Supervisor	_____	_____	_____
SH&E Representative	_____	_____	_____
Registered Professional Engineer (if applicable)	_____	_____	_____
Other	_____	_____	_____

Fall Protection

S3AM-304-PR1

1.0 Purpose and Scope

- 1.1 The purpose of this document is to establish policies and procedures for AECOM employees who perform work at or above specified heights and for employees who perform rope access work as determined by the given jurisdiction or according to client requirements, provided they exceed jurisdictional requirements. In the absence of applicable rules and/or regulations governing this type of work in a particular jurisdiction, the default requirement shall be 6 feet (1.8 meters) or greater in the construction, mining, and demolition industry, and 4 feet (1.2 meters) or greater in other industries (General Industry). The standard also addresses steep slope work where the work surface angle is greater than 30 degrees from horizontal.
- 1.2 Note that various jurisdictions may have provisions not noted in this procedure for alternative or additional requirements for types of fall protection to be used, or methods of implementing selected fall protection. Consult local experts and regulations.
- 1.3 Fall hazards include, but are not limited to, excavations, high-walls, unprotected elevations, ladders, scaffolds, floor holes, wall openings, formwork, rebar tying, inspection of dams, working on top of vehicles, equipment, or airframes, working over operating machinery, working above hazardous substances, and all other locations and operations where potential fall hazards exist.
- 1.4 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Anchor Point** – A secure point of attachment for lifelines, lanyards or deceleration devices that can withstand and absorb the arrest force as specified by the appropriate jurisdiction. Anchors may be temporary or permanent, and may be designed and tested or improvised and verified as capable of withstanding the arrest force. Improvised anchors may be a building structural component, crane, or other support.
- 2.2 **Authorized User** – An Employee who has completed appropriate fall protection training and has been approved to work at heights using Fall Protection / Prevention Systems.
- 2.3 **Base Surface** – The area immediately beneath an elevated structure or surface (ground, walking surface, floor, etc.). Used synonymously here with “grade.”
- 2.4 **Climbing Protection System** – A type of fall protection used on long ladders, poles, and towers that incorporates a permanently installed rail or cable that runs the length of the ladder. The climber's harness is attached to the rail or cable by a sliding device or sleeve that allows climbing freedom but locks the instant a fall is sensed.
- 2.5 **Deceleration Device** – A mechanism, such as a rope grab, rip-stitch lanyard, specially woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc., that serves to dissipate a substantial amount of energy during a fall arrest or to otherwise limit the energy imposed on an employee during fall arrest.
- 2.6 **Deceleration Distance** – The additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.
- 2.7 **Fall Protection / Prevention**
 - **Active fall protection system** – A system that requires workers to take specific actions, including wearing (and otherwise using) personal fall protection equipment and following prescribed procedures. Examples include travel restraint and fall arrest systems.

- **Passive fall protection / prevention system** – Any structure, fence, or barrier that will prevent falls during work at heights. Examples include ladder cages, guardrail systems and scaffolding.
- 2.8 **Free Fall Distance** – The vertical distance from the fall arrest attachment point on the employee's full body harness at onset of the fall to the fall arrest attachment point just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.
- 2.9 **Full Body Harness** – A tight-fitting harness that includes shoulder, chest and thigh straps, designed to fit the torso and spread the shock associated with arresting a fall over the entire torso area. Harnesses typically have connecting D-rings at chest level in the front and the back for attaching a lanyard, however connectors may be located at shoulders or waist depending upon the proposed use of the fall protection system (e.g. ladder climbing, work positioning, etc.).
- 2.10 **Grade** – (see Base Surface).
- 2.11 **Lanyard** – A line connecting a safety harness or safety belt to a safety line or structure. When used with a safety belt (if permitted by the given jurisdiction), the lanyard shall be short enough to prevent the employee from approaching the fall hazard (travel or fall restraint).
- 2.12 **Lifeline / Safety Line** – A flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.
- 2.13 **Personal Fall Arrest System** – A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors and full-body harness and may include a lanyard, deceleration device, lifeline or suitable combinations of these.
- 2.14 **Rope access** – A means of access by descending or ascending a main line while the worker is protected by a safety line.
- 2.15 **Safety Belt** – If permitted by the given jurisdiction, a belt worn around the waist that when attached to an anchor point with a lanyard prevents a worker from approaching a fall hazard (travel or fall restraint). Safety belts are prohibited as a means of fall protection.
- 2.16 **Safety-Monitoring System** – An administrative control in which a competent person is responsible for recognizing and warning employees of fall hazards. When no other alternative fall protection measures are available, a safety monitoring system shall be implemented.
- 2.17 **Standard Railing** – Railing provided to enclose open-sided work platforms and consisting of a top rail, intermediate rail, toe board, and posts. Refer to *S3AM-342-PR1 Temporary Floors, Stairs, Railings and Toe-boards*.
- 2.18 **Travel Restraint System** – A system designed to prevent Employees from reaching an unprotected edge. Harness and lanyard are connected to a lifeline and suitable anchor, with the system adjusted to limit travel.
- 2.19 **Work at Heights** – Any work/job/task to be performed above the normal walking/working surface that necessitates the use of some form of fall protection as determined by the applicable governing rules and regulations. In the absence of applicable rules and/or regulations governing this type of work in a particular jurisdiction, the default requirement shall be 6 feet (1.8 meters) or greater in the construction, mining, and demolition industry, and 4 feet (1.2 meters) or greater in other industries (General Industry).

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation
- 3.3 S3AM-202-PR1 Competent Person Designation
- 3.4 S3AM-208-PR1 Personal Protective Equipment

- 3.5 S3AM-209-PR1 Risk Assessment & Management
- 3.6 S3AM-218-PR1 Permit to Work
- 3.7 S3AM-311-PR1 Scaffolding
- 3.8 S3AM-314-PR1 Working Alone
- 3.9 S3AM-323-PR1 Aerial Work Platforms
- 3.10 S3AM-342-PR1 Temporary Floors, Stairs, Railings & Toe-boards
- 3.11 S3AM-128-PR1 Medical Screening & Surveillance

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager / Supervisor

The Manager / Supervisor has primary responsibility for ensuring that work done at elevations is done safely. He/she is responsible for implementation of the requirements of this procedure.

- Confirm all work at height is conducted in accordance with applicable legislation.
- Confirm Employees who perform work at heights are familiar with this procedure and have appropriate training.
- Designate a Competent Person to monitor the safety of other employees.
- Confirm personnel are apprised of any site-specific hazards prior to performing work at heights.
- Confirm required personal protective equipment (PPE), including fall protection / prevention equipment is available on site as necessary.
- Prepare and maintain on site fall rescue plan, equipment and personnel according to jurisdictional requirements.
- Maintain a high level of health and safety consciousness among employees.
- Maintain regular communications with employees and the SH&E Manager, as necessary.

4.1.2 Competent Person

A Competent Person (*see S3AM-202-PR1 Competent Person Designation*) will be designated to:

- Recognize fall hazards.
- Prepare and supervise the implementation of fall protection plans and rescue plans.
- Confirm that one or more fall protection or prevention systems outlined in this standard is provided at all locations where fall hazards exist.
- Confirm that all Employees working with and around fall hazards and fall protection systems are properly trained.
- Confirm that access controls to areas with fall hazards are effective.
- Inspect fall protection equipment.
- Warn Employees if they are unaware of a fall hazard or are acting in an unsafe manner.
- Be on same working surface, within visual sight and close enough for verbal communication of Employees being monitored if a safety-monitoring system is employed.
- Not have other assignments that would take Competed Person's attention from the monitoring function if a safety-monitoring system is employed.

4.1.3 SH&E Manager

The SH&E Manager is the individual responsible for the interpretation of this procedure. The SH&E Manager shall:

- Advise supervisors and site personnel on matters relating to climbing safety or other work to be performed at heights according to local legislation.
- Recommend appropriate PPE and climbing safety equipment to protect Employees.
- Work with the Manager / Supervisor to confirm that sufficient PPE and equipment are available.
- Perform field audits to monitor the effectiveness of this procedure and to confirm compliance with it.
- Maintain contact with Manager / Supervisor to regularly evaluate site conditions and new information that might require modifications to this procedure.
- Conduct training or briefings, when necessary, and to explain the content of this procedure and site hazards to Employees.
- Assist as required in investigation of incidents that resulted or could have resulted in an injury.

4.1.4 **Employees**

This procedure will not be effective unless employees and contractors make a conscientious effort to comply with it and to exercise good judgment in performing the tasks. The following specific responsibilities are incumbent on field personnel:

- Obtain and read a copy of this procedure and the applicable fall protection plan prior to the start of on-site work.
- Be familiar with local legislation.
- Confirm Working at Heights training is up to date and be prepared to produce proof of training.
- Understand and use appropriate fall protection systems as required.
- Review and be familiar with site specific fall rescue plan, equipment and personnel.
- Conduct pre-use inspections of equipment.
- Bring forth any questions or concerns regarding fall protection or this procedure to the Manager / Supervisor or SH&E Manager.
- Comply with this procedure, client or work location requirements and local legislation.

4.2 **General / Restrictions**

4.2.1 Fall protection is required and will be provided for any work/job/task to be performed above the normal walking/working surface at heights as determined by the applicable governing rules and regulations. In the absence of applicable rules and/or regulations governing this type of work in a particular jurisdiction, the default requirement shall be 6 feet (2 meters) or greater in the construction, mining, and demolition industry, and 4 feet (1.2 meters) or greater in other industries (General Industry).

4.2.2 Prior to work commencing:

- The appropriate Fall Protection Plan, Fall Rescue Plan, and as applicable, the Alternative Fall Protection Permit, shall be in place and be reviewed (including its associated requirements and fall protection regulations) with all affected employees. Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
- Employees shall be trained appropriately for the fall protection system to be used.
- Control or restrict access below or around the employees working at elevation.
- Confirm the use of barricades, caution tape, and signs identify restricted areas
- Applicable fall protection regulations shall be reviewed prior to work commencing.

4.2.3 Employees will not undertake climbing under personal conditions of fatigue, sickness, or injury, nor will they expose themselves to unusual or unacceptable risks.

- Employees using medications that may interfere with alertness or physical strength will not perform work at elevations.

- Managers will not allow Employees known to be experiencing personal or psychological stress to undertake work at elevations
- 4.2.4 Any equipment chosen to support a person at height should be such that it cannot be accidentally removed, dislodged or become unfastened from the rope, lanyard, or anchor point while a person is suspended from it.
- 4.2.5 Fall arrest equipment shall meet applicable jurisdictional requirements and bear the required standards (e.g., NFPA, ASTM, CSA, ANSI, CE, etc.) label, and be tagged as formally inspected and certified annually according to the manufacturer's specifications.
- 4.2.6 Visually inspect positioning, arrest, and restraint components before each use for wear, damage, or deterioration. Defective components are removed from use and tagged out to prevent others from using them. Refer to *S3-304-FM1 Fall Arrest Harness Inspection*, *S3AM-304-FM2 Fall Arrest Lanyard Inspection*, *S3AM-304-FM3 Fall Arrest Life Line Inspection*, *S3AM-304-FM4 Fall Arrest Rope Grab Inspection*, *S3AM-304-FM5 Fall Arrest Cable Sling Inspection* and *S3AM-304-FM6 Fall Arrest Carabiner Inspection* checklists or equivalent documents, to verify equipment is fit for use.
- 4.2.7 Any fall arrest components which are damaged or have been involved in a fall shall be tagged out and removed from service. If possible and permitted, the components shall be repaired, and recertified prior to return to service.
- 4.2.8 Employees shall use the buddy system to continually check each other's harness and D-ring to confirm that the harness is not too loose and/or the D-ring is appropriately positioned (e.g., has not slipped down the back).
- 4.2.9 Fall protection equipment shall be properly assembled, inspected, used, maintained, stored, and disassembled.
- 4.2.10 Use Personal Protection Equipment in accordance with manufacturers' specifications and as specified in the *S3AM-208-PR1 Personal Protective Equipment* procedure.
- 4.2.11 Do not attempt to repair or modify equipment unless properly trained and certified to do so.
- 4.2.12 If there is a question of unacceptable risk in working at any elevated work location, the work shall not be done until such questions are dealt with. Alternatives to climbing (elevators, aerial lifts, etc.) shall be used when practical. Refer to the *S3AM-323-PR1 Aerial Work Platforms* for more specifics.
- 4.2.13 All incidents, including falls and near misses, shall be reported and appropriately investigated in accordance with *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*.
- 4.3 Working at Heights
- 4.3.1 A task hazard assessment (THA) is required prior to initiating a task, including work at height tasks as explained in *S3AM-209-PR1 Risk Assessment & Management*. Additionally, those tasks that require personnel to work above rotating machinery, hazardous chemicals, vehicular traffic, water or other recognized hazards shall be included in the assessment. The assessment shall include the potential for persons falling as a result of working at height as well as the hazards of objects, machinery, and tools that may fall from a height, potentially striking a person working below.
- 4.3.2 Each recognized work at height hazard shall be mitigated to comply with applicable governing regulations. Mitigation control methods shall adhere to the hierarchy of controls described below:
- The preferred form of work at height hazard mitigation is elimination or substitution such as moving planned work to ground level or substitution of a process, sequence, or procedure so that employees are no longer exposed to a fall hazard;
 - Passive fall protection such as isolating or separating employees from the fall hazard through the use of guardrails or covered floor openings is the next preferable form of work at height hazard mitigation.
 - If the previous two methods are not feasible, active fall protection systems may be employed:
 - Travel restraint, which includes securing an employee to an anchor using a lanyard that is short enough to prevent the employee's center of mass from reaching the actual fall

hazard. Travel restraint systems are only to be used on walking or working surfaces with a slope of less than 18.4°.

- Fall arrest, which includes systems to stop an employee's fall after it has begun (e.g., personal fall arrest systems, safety nets, etc.).
- A safety net.
- Administrative controls may be employed; including a control zone with a safety-monitoring system, boundary markings (i.e., tape, cable, signs and/or barricades) located 6 feet (2 meters) or more from an exposed edge, and maintaining three-points of contact.

4.3.3 Personal Fall Arrest Systems shall limit the shock / arresting force on the employee to that specified by the regulations of the applicable jurisdiction. In the absence of jurisdictional specifications, the maximum arresting force on the employee shall be 1350 pounds (6kN).

4.4 Fall Protection Training

4.4.1 Only properly trained personnel shall be permitted to perform work at height tasks. This includes employees required to perform the following tasks:

- Work on scaffolds erected by others.
- Select, inspect, wear and use personal fall arrest systems (refer to PPE procedure).
- Select anchor points.
- Work on and/or operate aerial lift devices.
- Work on and/or utilize fixed and portable ladders.
- Work on roofs (where applicable).
- Work around unprotected walking/working surfaces such unfinished mezzanines, etc.
- Rescue activities.
- Refer to *S3AM-003-PR1 SH&E Training*.

4.4.2 At a minimum, all training shall be documented and, at a minimum, shall detail the local regulatory requirements and include:

- Identifying the working at heights hazards and methods of elimination and control;
- Selection of fall protection systems and the associated equipment according to potential hazards and equipment compatibility (e.g. guardrail, travel restraint, personal fall arrest, safety net, warning line, safety monitoring systems, controlled access zones, etc.);
- Proper use, including assembly and disassembly, of fall protection equipment;
- Potential effects on the human body of a fall from heights while using fall protection systems;
- Calculation of fall distances, and pendulum effect;
- Care of fall protection equipment, including pre-use inspections and rejection criteria, maintenance, and storage in accordance with manufacturer's specifications;
- Limitations of fall protection systems and the various components; and
- Signs and symptoms of orthostatic intolerance (suspension trauma), the causes of orthostatic intolerance while suspended; and recommended prevention and rescue measures.

4.4.3 Retraining will occur when any of the following conditions occur:

- Deficiencies are identified in training.
- Work place changes.
- Fall protection systems or equipment changes that render previous training obsolete.

4.4.4 A Competent Person will be trained in accordance with *S3AM-202-PR1 Competent Person Designation*.

4.4.5 No employee shall attempt to perform work that he/she has not been trained to safely perform or that he/she considers unsafe, including specific activities involving work at heights.

- 4.4.6 Employees who regularly climb towers or stacks to heights in excess of 20 feet (6.09 meters), if applicable to the given jurisdiction, shall be required to participate in the Medical Surveillance Program. Refer to the *S3AM-128-PR1 Medical Screening & Surveillance*.
- 4.4.7 Proof of training shall be carried while working at heights and presented upon request.
- 4.5 Fall Protection Plan
 - 4.5.1 Where Personal Fall Arrest Systems are required, a task-specific Fall Protection Plan shall be developed prior to work commencing using *S3AM-304-FM7 Fall Protection Plan*, or equivalent, to confirm that Employees exposed to work at heights are protected from falls for 100 percent of the duration of their task, including the time it takes them to locate to their task (e.g. climbing a ladder, transferring materials, descending a pit or vault, and working within a cage arrangement).
 - 4.5.2 Fall Protection Plans shall be approved by the Qualified and/or Competent Person and SH&E Manager before work commences.
 - 4.5.3 The Fall Protection Plan shall specify:
 - The fall hazards at the work site. Consult the applicable Task Hazard Analysis (THA).
 - The fall protection system to be used (e.g. guardrails, travel restraint, fall arrest) and as applicable specify:
 - Adequate anchor points available at each location where Active Fall Protection Systems are used (Confirm any engineered anchor point documentation and inspection data are available).
 - Clearance distances and applicable system components.
 - Assembly/disassembly, maintenance, inspection and use of the applicable system components.
 - Site-specific procedures for the Personal Fall Arrest System(s) to be used.
 - Limitations of the systems to be used.
 - A rescue plan including the procedures to be used if a worker falls, is suspended by a personal fall arrest system or safety net and needs to be rescued, or requires rescuing from the working height.
 - 4.5.4 Note: The Fall Protection Plan shall be available at the work site and reviewed with all employees, including affected workers, before beginning any work where there is a risk of falling. This includes any training or review of equipment usage.
 - 4.5.5 Identify fall hazards on an ongoing basis and review fall protection equipment needs. If conditions change or it is determined the system in use does not provide adequate protection, the work from heights shall be suspended. The Fall Protection Plan shall be appropriately revised and reissued prior to work recommencing.
- 4.6 Alternative Fall Protection Permit
 - 4.6.1 As permitted by the applicable jurisdiction, when traditional fall protection systems (e.g., guardrails, harnesses) are impractical, a Manager may authorize an alternative method of Fall Protection involving administrative controls (e.g., safety-monitoring systems, boundary markings, etc.).
 - 4.6.2 The Fall Protection Plan shall be supplemented with an Alternative Fall Protection Permit (*S3AM-304-FM8 Alternative Fall Protection Permit* or equivalent).
 - This option is available only to employees engaged in work who can demonstrate that it is infeasible or it creates a greater hazard to use conventional fall protection equipment.
 - This may include, but is not limited to, steep slope (>30 degrees from horizontal) work along graded roads, on the face of dams, on top of an aircraft on the flight line, rope access systems on vertical or nearly vertical surfaces (refer to *S3AM-304-ATT1 Rope Access Work*) and work in other remote or inaccessible steep work areas. This does not include roofing applications, as appropriate equipment and applicable regulatory guidance exists.

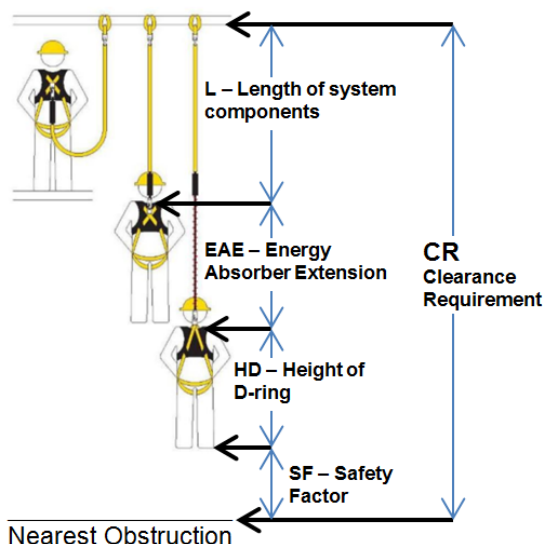
- 4.6.3 The Alternative Fall Protection Permit shall be prepared, and thereafter changed in any way, by a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, is qualified in fall protection.
- 4.6.4 Employees working under the Alternative Fall Protection Permit shall review the Permit and be properly trained and be accompanied by a Competent Person acting as the Safety Monitor.
- 4.6.5 Alternative Fall Protection Permits shall be approved by a Competent Person. Alternative Fall Protection Permits shall not be authorized if environmental factors pose an increased risk (e.g., inclement weather/rain).
- 4.6.6 Alternative Fall Protection Permits shall be posted where the work is taking place. If that is not feasible, the permit should be posted in the closest possible area to where the work is taking place.
- 4.6.7 Alternative Fall Protection Permits expire at the end of the shift on which it was issued and a new permit shall be issued and approved for work that continues into the next shift.
- 4.7 Fall Rescue Plan
 - 4.7.1 A fall rescue plan shall be developed and included in the Fall Protection Plan for each specific project where employees will be working at height. The fall rescue plan shall incorporate procedures that will confirm prompt rescue in the event that any employee falls. As a minimum, the rescue plan should include:
 - Effective rescue procedures shall be established in advance of an event requiring the use of personal fall arrest systems. Rescue measures shall be capable of being initiated within 5 minutes of a fall and the worker shall be able to be relieved of strap pressure within 15 minutes.
 - Specific equipment and procedures to facilitate self-rescue, if applicable and appropriate.
 - As applicable, procedures for utilizing outside rescue services (e.g., client facility emergency services, local fire department rescue services, etc.).
 - Contact information for the proposed emergency services and method of summoning help.
 - Confirmation that outside rescue services will attend a rescue call.
 - Coordination requirements such as procedures for familiarizing the proposed rescues services with the potential rescue conditions.
 - 4.7.2 The appropriate rescue option shall be selected from the following:
 - Self-Rescue - A reliable method for self-rescue shall be developed and deployed which shall include the use of the "buddy system" when personnel are working in conditions where fall protection systems (other than standard guard rail systems) are employed. The "buddy" or assigned safety person shall remain within visual/verbal range to initiate rescue of the fallen worker if required and shall have a reliable method of communication (cell phone, radio, etc.) to summon rescue. The site specific methods used for self-rescue shall be identified in the following section.
 - Assisted Rescue - Provided either by a professional rescue agency or by qualified company personnel. Select the appropriate choice below (professional rescue agency or qualified company personnel).
 - A Professional Rescue Agency may be used to provide prompt rescue of fallen workers. If a professional rescue agency is going to be used they shall be contacted to review the potential rescue requirements. This review shall include a discussion of the types of fall protection used by company personnel and the environment where the agency may be called upon to perform a rescue. The rescue agency shall advise (in writing) the types of rescue it can perform and provide detailed instructions regarding how they are to be called and if they need to be advised when certain activities are planned or certain conditions exist in order to provide the fastest possible response.
 - Qualified Company Personnel may be used to provide prompt rescue of fallen workers. If outside professional rescue agencies cannot be relied upon to promptly rescue fallen

personnel, then company personnel shall be identified and trained to serve as rescue personnel. Training shall be conducted by a qualified training agency or company and shall include specific training on the methods and equipment which may be required during site-specific rescue scenarios. It shall include hands on training and certification to demonstrate proficiency in rescue and shall be of the duration recommended by the training agency/company. Equipment procured for use as well as practice requirements (drills) and recurring formal training requirements for the company rescue personnel shall conform to the recommendations and requirements set forth by the training agency/company and jurisdictional requirements.

- 4.7.3 Orthostatic intolerance, or suspension trauma, can start within 5 minutes of suspension. Symptoms include hot flushes, sweating, anxiety, numbness, rapid pulse and breathing, and sudden loss of consciousness (fainting). A fallen worker can become unconscious within 10 minutes and can die within 15 minutes. If recovery of a suspended worker is delayed, raise the knees of the person within 5 minutes and keep them in a sitting position for at least 30 minutes. **Never allow the body to lay flat.** Anyone who has fainted, has been suspended for over 10 minutes, or otherwise exhibits suspension trauma symptoms shall immediately obtain medical attention.

4.8 Clearance Distance

- 4.8.1 Before using any Personal Fall Arrest System the employee shall confirm they have selected a system that allows for ample clearance.
- To understand required clearance distances it is important to look to the manufacturer's labels on each component of the fall protection system. Each component of the fall protection system will behave differently during a fall.
 - Manufacturers are required to provide information to assist proper selection of components and accurate calculation of clearance requirements.
- 4.8.2 Consideration shall be given to the stretch in the harness, flipping and sliding of the D ring, stretch and elongation of the energy absorbing lanyard, elongation of the vertical lifeline (if present), and elongation of the horizontal lifeline (if present).
- 4.8.3 Calculations shall be completed given the components of the fall protection system to be used, the distance to the next level or obstruction below and a safety factor, typically 2 feet (0.6m), added.
- 4.8.4 Calculations of clearance requirements can be completed using the following formulas:



L – Initial total length of system components (lanyard, energy absorber, & connecting hardware)

HD – Height of D-ring from user's feet

DA – Distance between anchor point and unguarded edge.

EAE – Energy absorber extension.

DS – D-ring slippage (typically 1 foot [0.3m]).

SF – Safety factor (typically 2 feet [0.6m])

Measured from rigid anchor point at unguarded edge:

$$CR = L + EAE + HD + DS + SF$$

Measured from rigid anchor point away from unguarded edge:

$$CR = L + EAE + HD + DS + SF - DA$$

Remember to confirm equipment manufacturer's specifications are consulted when calculating clearance requirements.

4.9 Towers

- 4.9.1 Employees shall not climb a tower unless the tower has a fixed ladder that is equipped with fall protection or unless the employee is equipped with and utilizes a personal fall arrest system.

4.10 Steep Slope

- 4.10.1 Fall protection measures shall be used whenever the slope angle exceeds 30 degrees from horizontal (note that this excludes roofing applications, which are covered under Working at Heights). Activities include the inspection of dams, environmental surveys of timbered slopes, or other applications where traditional fall protection systems are impractical.

4.11 Guardrails

- 4.11.1 When possible, work areas under the control of AECOM that expose an employee or visitor to: a wall opening, open-sided floor, or platform of heights greater than that specified by the applicable jurisdiction, shall be equipped with a guardrail.
- In the absence of applicable rules and/or regulations in a particular jurisdiction, the default minimum height shall be 6 feet (1.8 meters) or greater in the construction, mining, and demolition industry, and 4 feet (1.2 meters) or greater in other industries (General Industry).
 - Unless otherwise governed by a more stringent local regulation, the guardrail system shall consist of a top rail, intermediate rail, and posts, and have toe-boards installed on working / walking surfaces as necessary to provide falling object protection.
 - Install paneling or screening from the top of the toe-board to the top rail or mid-rail when tools, equipment, or materials are piled higher than the top of the toe-board. Sidewalk sheds or canopies may be provided as appropriate.
 - Refer to *S3AM-342-PR1 Temporary Floors, Stairs, Railing & Toe-Boards* for guardrail specifications.
- 4.11.2 Toe-boards, covers, and guardrails shall be constructed in the manner as described in the regulations and shall not be removed without adjusting the fall protection plan in order to mitigate the hazard.
- 4.11.3 When guardrails are used around holes that are used for access, such as ladderways, provide a gate or offset the guardrail so that a person cannot walk directly into the hole.
- 4.11.4 When guardrails are used at hoisting areas, place a chain, gate, or removable guardrail section across the access point when hoisting operations are not taking place.
- 4.11.5 Where wire rope is used for construction of guardrail systems:
- Confirm the wire rope used for construction of the guardrail system is a minimum of ¼ inch (0.6 centimeters) in diameter.
 - Flag the toprail with high-visibility material every 6 feet (2 meters).
 - Attach wire rope to existing structures, equipment, or other wire ropes using appropriate and recommended number of fasteners (e.g., Crosby clips).
- 4.11.6 Guardrails – especially wooden guardrails – shall be inspected regularly.

4.12 Anchors

- 4.12.1 Temporary or Permanent Travel Restraint / Work Positioning anchors shall have an ultimate load capacity, as specified by the applicable jurisdiction, in any direction in which the load may be applied.
- In the absence of applicable rules and/or regulations in a particular jurisdiction, the default static strength of an anchor used in work positioning systems shall be at least 3,000 pounds (1,365 kilograms).

- In the absence of applicable rules and/or regulations in a particular jurisdiction, the default static strength of an anchor used in travel restraint systems shall be at least 1,000 pounds (455 kilograms).
 - Anchors shall be installed, used and removed according to the manufacturer's specifications.
 - Temporary Travel Restraint anchors shall also be permanently marked for use with "Travel Restraint Only" and removed from service immediately following completion of the work project or within the time specified by the manufacturer.
- 4.12.2 Temporary or Permanent Personal Fall Arrest system anchors shall have an ultimate load capacity, as specified by the applicable jurisdiction, per worker attached, in any direction in which the load may be applied.
- In the absence of applicable rules and/or regulations in a particular jurisdiction, the default static strength of an anchor used in fall arrest systems shall be 5000 pounds (2,268 kilograms).
 - No more than one worker shall attach to a single anchor point unless manufactured and designed for this purpose.
 - Workers shall not attach their personal fall arrest system to an anchor used to support or suspend a platform.
 - Anchors for Horizontal Lifeline Systems shall be designed, installed and used in accordance with the manufacturer's instructions or specifications certified by a Professional Engineer.
 - Workers shall choose a fall arrest anchor that is above their shoulders, if possible, to reduce free fall distance and located to minimize the potential for a swing fall hazard.
- 4.12.3 The use of motor vehicles as anchoring points is prohibited.
- 4.13 Personal Fall Arrest Systems
- 4.13.1 All aspects of Personal Fall Arrest Systems shall be designed, installed, and used under the supervision of a Competent Person.
- 4.13.2 Set up Personal Fall Arrest Equipment to limit the free fall distance to the shortest distance possible and not exceeding that prescribed in the Federal/State/Provincial/Territorial regulations. Adhere to the Clearance Distance documented in the applicable *S3AM-304-FM8 Fall Protection Plan* or equivalent.
- 4.13.3 Maintain a safety factor of at least 2 in all components of a Personal Fall Arrest System (e.g., the static strength of the system should be at least two times the maximum required arresting force).
- 4.13.4 Safety belts (body belts) are prohibited as a means of fall arrest, although they may have application as a positioning device.
- 4.13.5 Use only full-body harnesses, shock-absorbing lanyards, lifelines, and anchorage points that meet the following criteria:
- Body harness design and construction shall meet the specifications applicable to the equipment and jurisdiction (e.g., NFPA, UIAA, ANSI, ASTM, CSA, CE, etc.).
 - The Full Body Harness shall be suitably sized for the body mass and shape of the worker
 - All hardware shall be dropforged or pressed steel with a corrosion-resistant finish. Surfaces shall be smooth and free of sharp edges.
 - D-rings and snaphooks shall have a minimum tensile strength of 5,000 pounds (2,270 kg or 22kN) in all directions of potential loading.
 - All snaphooks shall be of the auto-locking type.
 - Ropes and webbing used in lanyards, lifelines, and body harnesses shall be made of synthetic fibers.

- The attachment point (D-ring) of a body harness should be located in the center of the wearer's back near shoulder level, or above the wearer's head. Note that front-mounted D-rings are allowed if the personal fall arrest system is designed to restrict free fall distances to 2 feet (60 centimeters) or less and limit the maximum fall arrest loads to 900 pounds (410 kilograms) of force or less.
 - Maintain manufacturer's specifications of total dynamic load capability of lifelines used.
 - Connect lifelines independently of other lines and to an adequate anchor point only.
 - Horizontal lifelines shall be designed, installed, and used according to an engineered design and under the supervision of a Competent Person, and be capable of supporting at least 5,000 pounds (2,270 kilograms) of force per employee attached.
 - Confirm that only one employee is attached to any one vertical safety line.
 - Lanyards and vertical lifelines shall have a minimum breaking strength of 5,000 pounds (2,270 kilograms).
 - Self-retracting lifelines and lanyards that limit free-fall to 2 feet (60 centimeters) or less shall be capable of sustaining a minimum tensile load of 3,000 pounds (1,360 kilograms) in the fully extended position.
 - Self-retracting lifelines and lanyards that do not limit free fall to 2 feet (60 centimeters) or less, ripstitch, and other shock-absorbing lanyards shall be capable of sustaining a minimum tensile load of 5,000 pounds (2,270 kilograms) in the fully extended position.
 - The shock-absorbing lanyard shall meet the applicable CSA / ANSI standards and local regulatory requirements.
 - Personal fall arrest systems, when stopping a fall, shall:
 - Limit arresting force on an employee to 1,800 pounds (820 kilograms) when used with a body harness;
 - Be rigged such that an employee can neither free fall more than 6 feet (1.8 meters) nor contact any lower level;
 - Bring an employee to a complete stop and limit maximum acceleration distance an employee travels to 3.5 feet (1.1 meters); and
 - Have sufficient strength to withstand twice the potential impact energy of an employee free-falling a distance of 6 feet (1.8 meters), or the free-fall distance permitted by the system, whichever is less.
 - Positioning devices shall limit free fall to less than 2 feet (0.6 meters).
- 4.13.6 Never tie off to guardrail systems or hoists unless the intended anchor point is certified by the manufacturer or an engineer to the required ultimate load capacity, as specified by the applicable jurisdiction.
- 4.13.7 Confirm each employee working from a swing scaffold, bosun's chair, or other suspended work platform is provided with a lifeline separate from the suspended work platform.
- 4.13.8 Protect lanyards and lifelines against cuts and abrasions.
- Do not wrap the lanyards and/or rope around beams, girders, pipes, etc.
 - Where tools are used that have the potential to sever, abrade, or burn lanyards, lifelines, or safety straps, replace synthetic materials with wire rope or wire-cored manila rope of equal strength.
- 4.13.9 Use rope grabs to attach to vertical lifelines – never use knots.
- 4.14 Safety Net Systems (Construction Applications)

- 4.14.1 Provide safety net systems at locations where a fall hazard of 6 feet (1.8 meters) or greater in the construction, mining, and demolition industry, and 4 feet (1.2 meters) or greater in other industries (General Industry), and other forms of fall protection are not feasible.
- 4.14.2 Safety net systems shall meet the applicable jurisdictional requirements. In the absence of applicable rules and/or regulations in a particular jurisdiction, or the manufacturer's instructions, the following requirements shall apply:
 - Install safety nets as close as possible under the walking/working surface on which employees are working, but never more than 30 feet (9 meters) below this level.
 - Require that the potential fall area from the walking/working surface to the net is unobstructed.
 - Install safety nets with enough clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified below.
 - Extend the outer edge of the net 8 feet (2.5 meters) from the edge of the working surface when the vertical distance from the working level to the net is 5 feet (1.5 meters) or less.
 - Extend the outer edge of the net 10 feet (3 meters) from the edge of the working surface when the vertical distance from the working level to the net is 5 to 10 feet (1.5 to 3 meters).
 - Extend the outer edge of the net 13 feet (4 meters) from the edge of the working surface when the vertical distance from the working level to the net is greater than 10 feet (3 meters).
 - Conduct a drop test of the safety net after installation and before being used as a fall protection system; whenever relocated; after major repair; and at 6-month intervals if left in one place.
 - Conduct the drop test by dropping a 400 pound (180 kilograms) sandbag, 30 inches (76 centimeters) in diameter, into the net from at least 42 inches (107 centimeters) above the highest walking/working level at which employees are exposed to a fall.
 - Inspect safety nets at least once a week (and after any occurrence that could affect the integrity of the system) for wear, damage, and deterioration. Remove defective nets and components from service.
- 4.14.3 Remove all materials, scrap, equipment, and tools that have fallen into the net as soon as possible, but at least before the next work shift.
- 4.15 Hole Covers
 - 4.15.1 Guardrails are the best method of protecting workers around openings in floors and roofs, but are sometimes not practical and hole covers are required.
 - 4.15.2 Provide covers in roadways and vehicle aisles that are capable of supporting at least twice the maximum axle load of the largest vehicle expected to cross over the cover.
 - 4.15.3 Provide walking/working surface hole covers that are capable of supporting at least twice the weight of Employees, equipment, and materials that may be imposed on the cover at any one time.
 - 4.15.4 Secure covers at the time of installation to prevent displacement by the wind, equipment, or Employees.
 - 4.15.5 Clearly mark all hole covers to provide warning of the hazard (e.g., DO NOT REMOVE. DANGER! HOLE IN FLOOR).
- 4.16 Safety Monitoring Systems, Warning Line Systems, and Controlled Access Zones
 - 4.16.1 These control measures shall be approved by the Competent Person prior to performing any roofing, overhand bricklaying, leading edge, or other elevated work that may require the use of one or more of these systems.
- 4.17 Equipment Inspection
 - 4.17.1 Any fall protection equipment that reveals an unsafe condition shall be removed from service and:

- Rendered unusable;
 - Destroyed; or
 - Sent back to the manufacturer.
- 4.17.2 Synthetic webbing shall not be taped, painted or written on with markers, unless approved by the manufacturer.
- 4.17.3 Confirm manufacturer's labelling is present.
- 4.17.4 All fall protection equipment shall be re-certified as specified by the manufacturer.
- 4.17.5 Employee shall use the *S3AM-304-FM1 Fall Protection Harness Inspection* or equivalent checklist to inspect harnesses before each use:
- Inspect the label:
 - Labels shall be attached to equipment; any equipment without a label shall be removed from service immediately.
 - Label shall include appropriate Standards identification.
 - Label shall include inspection verification per manufactures instructions.
 - Inspect the webbing:
 - Inspect the entire surface of webbing for damage. Beginning at one end, bend the webbing in an inverted "U."
 - Watch for frayed edges, broken fibers, pulled or broken stitches, cuts, or chemical damage, abrasion, excessive wear, altered or missing straps, burns, and heat or chemical exposure of the webbing.
 - Broken webbing strands generally appear as tufts on the webbing surface.
 - Inspect under any removable padding.
 - Inspect load indicators per manufactures instructions.
 - Replace according to manufacturers' guidelines.
 - Inspect buckles and hardware:
 - Several types of buckles are used on fall protection equipment. Common ones are mating buckles, tongue & grommet buckles and quick connect (seat belt) buckles.
 - Inspect the buckles and hardware (including D-ring and snaphooks for cracks, burrs, distortion, sharp edges, pitted surfaces, discoloration from bending, rusting, corrosion, chemical damage, burns or any other significant defects. Components shall be straight and compare to others for consistent appearance.
 - Carefully check corners and attachment points of the center bar. They should overlap the buckle frame and move freely back and forth in their sockets. The roller should turn freely on the frame.
 - Inspect the belt for loose, distorted, or broken grommets.
 - Check that rivets are tight and cannot be moved. The body side of the rivet base and outside rivet burr should be flat against the material. Make sure the rivets are not bent.
 - Inspect for pitted or cracked rivets that show signs of chemical corrosion.
 - Replace the belt if the "D" ring is not at a 90 degree angle and does not move vertically independent of the body pad or "D" saddle.
 - Check bag rings and knife snaps to see that they are secure and working properly. Check tool loop rivets. Check for thread separation or rotting, both inside and outside the body pad belt.
 - Snaphook keeper (latch) should be seated into the snap nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to close the keeper firmly.

- 4.17.6 Employee shall inspect lanyards before each use. Document inspection at a minimum monthly, using *S3AM-304-FM2 Fall Protection Lanyard Inspection* or equivalent.
- Inspect shock-absorbing lanyard per the style, manufactures instructions and webbing inspection above.
 - Inspect snap hooks and connection points for signs of damage or wear, free movement, self-closing/self-locking gates, excessive gate play per the manufactures instructions.
- 4.17.7 Employee shall inspect life lines before each use. Document inspection at a minimum monthly, using *S3AM-304-FM3 Fall Protection Life Line Inspection* or equivalent.:
- Inspect for any signs of abrasion, excessive wear, burns, and UV, heat or chemical exposure / contamination.
 - Inspect hardware or snap hooks as described in Harness or Lanyard inspection above.
 - Rotate the rope and inspect from end to end for fuzzy, worn, broken, cut fibers or hockingling (kinking and/or untwisting due to constant turning in the same direction or shock loading). Weakened areas have noticeable changes in the original rope diameter.
 - Inspect wire rope for bird nesting, kinks, broken strands, corrosion, or stretched eyelets.
 - Replace when rope diameter is not uniform throughout or does not meet any of the criteria above.
- 4.17.8 Employee shall inspect the rope grab before each use. Document inspection at a minimum monthly using *S3AM-304-FM4 Fall Protection Rope Grab Inspection* or equivalent.
- Confirm smooth operation of moving parts, including hinge, cam lever and thumb screws.
 - Apply rope grab to a suitable rope to confirm locking mechanism fully engages. Confirm rope grab has appropriate labelling (e.g. indicating direction of rope).
- 4.17.9 Employee shall to inspect the cable sling before each use. Document inspection at a minimum monthly using *S3AM-304-FM5 Fall Protection Cable Sling Inspection* or equivalent.
- Inspect for cut fibers or damaged stitches inch by inch by flexing the strap in an inverted "U." Note cuts, frayed areas, or corrosion damage.
 - Check friction buckles for slippage and sharp buckle edges.
 - Check connection points or D rings for signs of damage or misuse.
 - Remove from service any strap that does not pass inspection criteria.
- 4.17.10 Inspecting retractable lifelines before each use:
- Refer to Manufactures instructions on annual inspection criteria.
 - Retractable lifelines contain a cable wound around a drum with a spring that removes slack from the line and an inertial latching device that stops a sudden decent. Slowly pull entire cable out and inspect for damage. Pull rapidly to check inertia latch.
 - Inspect load indicator.
 - Remove from service any retractable lifeline that does not pass inspection criteria.
- 4.17.11 Inspect hardware and anchorage points before each use:
- Inspect rope grabs, carabiners and other hardware for signs of damage, and free movement of pivot points and self-closing/self-locking components. Refer to *S3AM-305-FM6 Fall Protection Carabiner Inspection* or equivalent.
 - Carabiners and similar connectors shall be equipped with screw-gates or self-locking methods of closure to prevent inadvertent unfastening or release.
 - Confirm rope grab is properly sized for application and vertical lifeline.
 - The anchorage point is the position on an independent structure to which the lanyard, lifeline or anchor adaptor is attached. It should be capable of supporting a minimum static load per the local regulatory requirements.

- Confirm any engineered anchorage has the appropriate documentation.
- If there are any concerns about hardware or anchorage points refer the matter to the site Supervisor or Competent Person for further review.

4.17.12 Visual inspection of tower before each use:

- Prior to ascending a tower or structure, a visual inspection of its general conditions (guys, rungs, anchors, etc.) shall be made. If for any reason an employee believes the tower is unsafe to climb, he/she should not climb until corrections are made; he/she should contact the Supervisor if the work cannot be performed safely.

4.18 Equipment Storage

4.18.1 Fall protection equipment is not indestructible, but is very sensitive to certain conditions. For example:

- Chemical substances can cause failure in the synthetic webbing material.
- Dirt/mud can also break down the fibers in a synthetic component.
- Sunlight is very damaging to synthetic components as the ultraviolet rays break down the synthetic composition of the material.
- Metal components are affected by heat, welding slag or severe impact.

4.18.2 All fall protection equipment should be kept clean, dry and stored inside away from chemicals, moisture, abrasives and sunlight.

4.19 Working Alone

4.19.1 No employee shall perform work at heights alone.

- Climbing or work at heights shall be carried out in accordance with the Fall Protection Plan and only in the presence of a co-worker, contractor, or client who will be in visual and auditory range at all times during the critical phases of the work and is knowledgeable on or able to execute the site rescue plan.
- This standby observer shall be able to make immediate contact with emergency services.
- Refer to the *S3AM-314-PR1 Working Alone* procedure for more specifics when working alone.

4.20 Environmental Conditions

4.20.1 Climbing or other work at heights will not be undertaken if adverse conditions such as high winds, storms (particularly lightning), inadequate illumination, any type of precipitation, or severe icing exist unless deemed safe by the Competent Person. Extreme caution should be exercised after any type of rain or snowstorm.

4.21 Other Protective Equipment

4.21.1 Other required PPE, suitable for the task, shall be available and worn by personnel who perform work at heights. In addition to safety belts or harnesses and lanyards, other PPE, such as safety helmets (hard hats with chin straps) shall be worn; clothing shall be adequate to protect against inclement weather; safety glasses or goggles, rugged safety shoes with heels should be worn to provide protection as well as adequate support; and gloves should be worn as needed.

5.0 Records

5.1 Records of training and medical surveillance exams will be maintained according to *S3AM-003-PR1 SH&E Training* and *S3AM-128-PR1 Medical Screening & Surveillance*.

5.2 Records from this procedure shall be retained by each project and/or office location, including:

- Task Hazard Assessments.
- Fall Protection Plans, including Alternative Fall Protection Permits.
- All equipment inspection forms.

6.0 Attachments

- 6.1 [S3AM-304-ATT1 Rope Access Work](#)
- 6.2 [S3AM-304-FM1 Fall Protection Harness Inspection](#)
- 6.3 [S3AM-304-FM2 Fall Protection Lanyard Inspection](#)
- 6.4 [S3AM-304-FM3 Fall Protection Lifeline Inspection](#)
- 6.5 [S3AM-304-FM4 Fall Protection Rope Grab Inspection](#)
- 6.6 [S3AM-304-FM5 Fall Protection Cable Sling Inspection](#)
- 6.7 [S3AM-304-FM6 Fall Protection Carabiner Inspection](#)
- 6.8 [S3AM-304-FM7 Fall Protection Plan](#)
- 6.9 [S3AM-304-FM8 Alternative Fall Protection Permit](#)

Americas

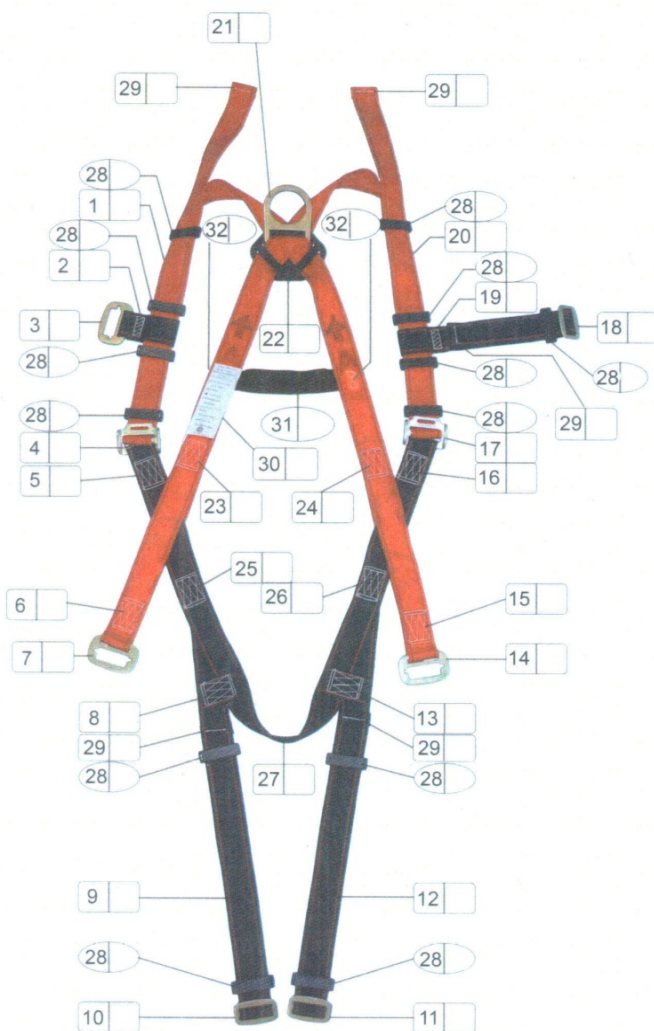
Fall Protection Harness Inspection

S3NA-304-FM1

INSTRUCTIONS:

1. A competent person shall perform a documented inspection of safety harness upon initial use, after a fall arrest, and annually.
2. All documentation must be maintained in the appropriate files (project, program, office, etc.).
3. Visual inspection of assigned harnesses and lanyards are to be performed prior to each use.
4. Any harness or lanyard failing the criteria below is to be *removed from service*, and given to the **SH&E Manager** with its checklist.

Harness Manufacturer:		Serial #:		Class:		Manufacture Date:	
Inspector's Name:			Inspector's Signature:				
Office/site:			Date:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	



	Description	Pass	Fail
1	Left Shoulder Webbing	<input type="checkbox"/>	<input type="checkbox"/>
2	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
3	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
4	Adjusting Buckle	<input type="checkbox"/>	<input type="checkbox"/>
5	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
6	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
7	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
8	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
9	Left Leg Webbing	<input type="checkbox"/>	<input type="checkbox"/>
10	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
11	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
12	Right Leg Webbing	<input type="checkbox"/>	<input type="checkbox"/>
13	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
14	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
15	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
16	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
17	Adjusting Buckle	<input type="checkbox"/>	<input type="checkbox"/>
18	Mating Buckle	<input type="checkbox"/>	<input type="checkbox"/>
19	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
20	Right Shoulder Webbing	<input type="checkbox"/>	<input type="checkbox"/>
21	Dorsal D-Ring	<input type="checkbox"/>	<input type="checkbox"/>
22	D-Ring Back Pad	<input type="checkbox"/>	<input type="checkbox"/>
23	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
24	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
25	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
26	Stitching	<input type="checkbox"/>	<input type="checkbox"/>
27	Sub-pelvic Strap	<input type="checkbox"/>	<input type="checkbox"/>
28	Belt Keepers	<input type="checkbox"/>	<input type="checkbox"/>
29	Stitching - end pattern	<input type="checkbox"/>	<input type="checkbox"/>
30	Product Label	<input type="checkbox"/>	<input type="checkbox"/>
31	Back Strap	<input type="checkbox"/>	<input type="checkbox"/>
32	Stitching – back strap	<input type="checkbox"/>	<input type="checkbox"/>
	Load Indicators	<input type="checkbox"/>	<input type="checkbox"/>

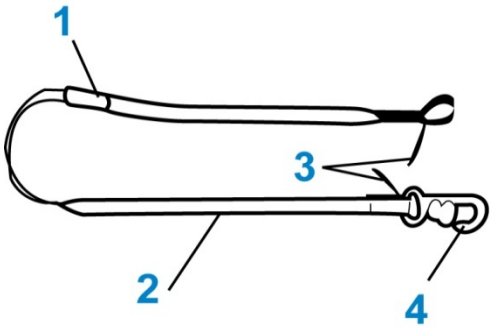
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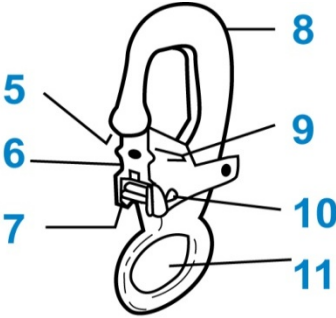
Americas

Fall Protection Lanyard Inspection

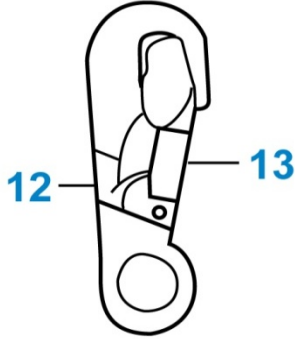
S3NA-304-FM2

Inspection				
Lanyard Manufacturer:		Inspector's Name:		
Serial Number:		Inspector's Signature:		
Date of Manufacture:		Date of Inspection:		
Office/site:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	





Snaphook, Self-locking
Style A



Snaphook, Self-locking
Style B

Item #	Description - Lanyard	Pass	Fail	Comments
1	Flag indicator	<input type="checkbox"/>	<input type="checkbox"/>	
2	Outside Core/Webbing	<input type="checkbox"/>	<input type="checkbox"/>	
	Core/absorber	<input type="checkbox"/>	<input type="checkbox"/>	
3	Wear Pads	<input type="checkbox"/>	<input type="checkbox"/>	
	Labelling (tags)	<input type="checkbox"/>	<input type="checkbox"/>	
	Stitching	<input type="checkbox"/>	<input type="checkbox"/>	
4	Snaphooks (Self-locking)	<input type="checkbox"/>	<input type="checkbox"/>	Style: A <input type="checkbox"/> / B <input type="checkbox"/>
5	Hook Nose	<input type="checkbox"/>	<input type="checkbox"/>	
6	Gate (keeper)	<input type="checkbox"/>	<input type="checkbox"/>	
7	Lock	<input type="checkbox"/>	<input type="checkbox"/>	
8	Hook Body	<input type="checkbox"/>	<input type="checkbox"/>	
9	Spring (inside gate)	<input type="checkbox"/>	<input type="checkbox"/>	
10	Hinge	<input type="checkbox"/>	<input type="checkbox"/>	
11	Eye	<input type="checkbox"/>	<input type="checkbox"/>	
12	Lock (style B)	<input type="checkbox"/>	<input type="checkbox"/>	
13	Gate (style B)	<input type="checkbox"/>	<input type="checkbox"/>	

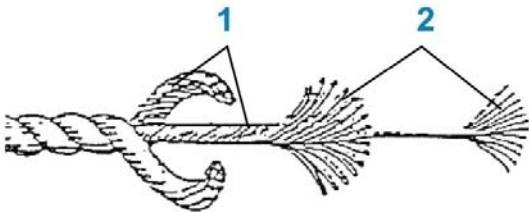
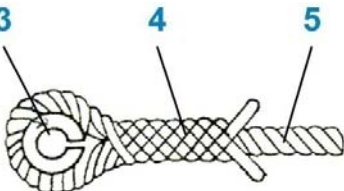
Comments:

Americas

Fall Protection Life Line Inspection

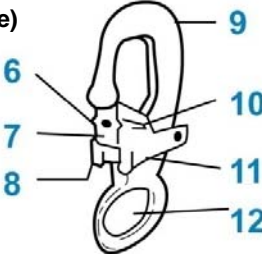
S3NA-304-FM3

Inspection				
Life Line Manufacturer:		Inspector's Name:		
Serial Number:		Inspector's Signature:		
Date of Manufacture:		Date of Inspection:		
Office/site:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	

Synthetic Rope Composition
(Three-Strand Laid Rope)

Spliced Eye



Snaphook, Self-locking

Item #	Description - Lanyard	Pass	Fail	Comments
1	Rope Strand	<input type="checkbox"/>	<input type="checkbox"/>	
2	Rope Fibers	<input type="checkbox"/>	<input type="checkbox"/>	
3	Thimbles & Eyes	<input type="checkbox"/>	<input type="checkbox"/>	
4	Rope Splice	<input type="checkbox"/>	<input type="checkbox"/>	
5	Synthetic Rope	<input type="checkbox"/>	<input type="checkbox"/>	
	Rope Diameter (entire length)	<input type="checkbox"/>	<input type="checkbox"/>	
	Rope Kinking / Untwisting	<input type="checkbox"/>	<input type="checkbox"/>	
	Labelling (tags)	<input type="checkbox"/>	<input type="checkbox"/>	
	Snaphook	<input type="checkbox"/>	<input type="checkbox"/>	
6	Hook Nose	<input type="checkbox"/>	<input type="checkbox"/>	
7	Gate (keeper)	<input type="checkbox"/>	<input type="checkbox"/>	
8	Lock	<input type="checkbox"/>	<input type="checkbox"/>	
9	Hook Body	<input type="checkbox"/>	<input type="checkbox"/>	
10	Spring (inside gate)	<input type="checkbox"/>	<input type="checkbox"/>	
11	Hinge	<input type="checkbox"/>	<input type="checkbox"/>	
12	Eye	<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

Americas

Fall Protection Rope Grab Inspection

S3NA-304-FM4

Inspection				
Lifetime Manufacturer:		Inspector's Name:		
Model/Serial Number:		Inspector's		
Date of Manufacture:		Date of Inspection:		
Office/site:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	

Item #	Description – Rope Grab	Fail	Pass	Comments
	Hinge	<input type="checkbox"/>	<input type="checkbox"/>	
1	Thumbscrew	<input type="checkbox"/>	<input type="checkbox"/>	
2	Metal Button	<input type="checkbox"/>	<input type="checkbox"/>	
3	Attachment Eye	<input type="checkbox"/>	<input type="checkbox"/>	
4	Body	<input type="checkbox"/>	<input type="checkbox"/>	
5	Cam Lever	<input type="checkbox"/>	<input type="checkbox"/>	
6	Black Cam	<input type="checkbox"/>	<input type="checkbox"/>	
7	Locking Mechanism/Lever	<input type="checkbox"/>	<input type="checkbox"/>	
	Labeling (Tags)	<input type="checkbox"/>	<input type="checkbox"/>	
	Springs	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

Americas

Fall Protection Cable Sling Inspection

S3NA-304-FM5

Inspection				
Manufacturer:		Inspector's Name:		
Model/Serial Number:		Inspector's Signature:		
Date of Manufacture:		Date of Inspection:		
Office/site:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	

Thimble

Flemish Eye Splice with
swaged fitting

Label
(can slide along line)

PVC covered
wire rope

Item #	Description – Rope Grab	Pass	Fail	Comments
1	Thimble	<input type="checkbox"/>	<input type="checkbox"/>	
2	Eye Splice	<input type="checkbox"/>	<input type="checkbox"/>	
3	Label	<input type="checkbox"/>	<input type="checkbox"/>	
4	Cable Casing	<input type="checkbox"/>	<input type="checkbox"/>	
5	Cable	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

Americas

Fall Protection Carabiner Inspection

S3NA-304-FM6

Inspection				
Manufacturer:		Inspector's Name:		
Model/Serial Number:		Inspector's Signature:		
Date of Manufacture:		Date of Inspection:		
Office/site:		Inspection Result:	Pass <input type="checkbox"/> / Fail <input type="checkbox"/>	

Item #	Description – Rope Grab	Pass	Fail	Comments
1	Nose	<input type="checkbox"/>	<input type="checkbox"/>	
2	Gate/Lock	<input type="checkbox"/>	<input type="checkbox"/>	Self close & lock
3	Hinge	<input type="checkbox"/>	<input type="checkbox"/>	
4	Dowel Pins	<input type="checkbox"/>	<input type="checkbox"/>	
5	Inner Sleeve	<input type="checkbox"/>	<input type="checkbox"/>	
6	Carabineer Body	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

Comments:

Americas

Fall Protection Plan

S3NA-304-FM7

PURPOSE

This fall protection plan, or equivalent shall be used to meet industry standards and the requirements of *S3NA-304-PR1 Fall Protection / Working at Heights* where workers are exposed to fall hazards. Fall protection plans must be approved by the Safety Health & Environment Manager, shall be readily available to all personnel, and shall be updated if conditions change and at least annually.

Manager / Supervisor _____ Job Number _____
 Location _____ Date _____

WORK BEING DONE

--

DESIGNATED PERSONNEL & DUTIES**QUALIFIED PERSON(S) if applicable**

Qualified personnel may be necessary to:

- Approve fall arrest attachment/anchorage points.
- Approve complex fall arrest systems.
- Fulfill rescue plan requirements if outside agencies are not used.

Names of Qualified Persons	Job Classification/Job Title

COMPETENT PERSON(S)

- Supervises and ensures that all Employees working with and around fall hazards and fall protection systems are properly trained and are Authorized Users.
- Ensures that access to controls to areas with fall hazards are effective.
- Conducts documented inspections of fall protection equipment at least annually.
- Trained in accordance with *S3NA-304-PR1 Fall Protection / Working at Heights*.

Names of Competent Persons	Job Classification/Job Title

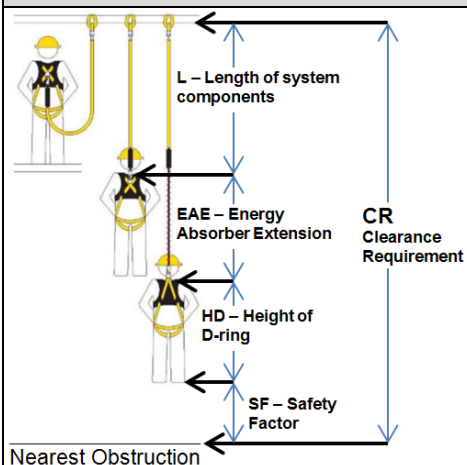
EMPLOYEES (Authorized Users)	
<ul style="list-style-type: none"> Utilize fall protection systems and inspect all fall protection equipment prior to use Trained in accordance with <i>S3NA-304-PR Fall Protection</i> to understand the fall protection system and equipment, including proper use, inspection, and storage 	
Names of Authorized Users	Names of Authorized Users

FALL HAZARD EVALUATION		
<input type="checkbox"/> Unprotected Edge <input type="checkbox"/> Ladder <input type="checkbox"/> Other	<input type="checkbox"/> Floor Openings <input type="checkbox"/> Stairway <input type="checkbox"/> Other	<input type="checkbox"/> Scaffold <input type="checkbox"/> Wall Openings <input type="checkbox"/> Work over Hazards
Additional Information:		

FALL PROTECTION SYSTEM (e.g. guardrails, travel restraint, fall arrest)		
<input type="checkbox"/> Guardrails <input type="checkbox"/> Safety Nets <input type="checkbox"/> Other	<input type="checkbox"/> Personal Fall Arrest <input type="checkbox"/> Hole Covers <input type="checkbox"/> Other	<input type="checkbox"/> Travel / Fall Restraint <input type="checkbox"/> Monitoring Systems <input type="checkbox"/> Other
System Description / Design (include specifics such as safety net size and exact location; anchor type(s), location and capacity; lifelines; falling object protection; etc.):		
Assembly / Disassembly:		
Use:		
Inspection and Maintenance:		
Limitations:		

FALL PROTECTION PROCEDURES

CLEARANCE DISTANCE



Other considerations:

DS – D-ring slippage DA – Distance between anchor point and unguarded edge

Measured from rigid anchor point at unguarded edge:

$$\text{CR} = \text{L} + \text{EAE} + \text{HD} + \text{DS} + \text{SF}$$

1 ft (0.3m) 2 ft (0.6m)

Measured from rigid anchor point away from unguarded edge:

$$\text{CR} = \text{L} + \text{EAE} + \text{HD} + \text{DS} + \text{SF} - \text{DA}$$

1 ft (0.3m) 2 ft (0.6m)

Remember to consult equipment manufacturer's specifications when calculating clearance requirements.

Comments:

ALTERNATIVE FALL PROTECTION PERMIT

An Alternative Fall Protection Permit shall be completed workers are exposed to fall hazards and passive fall protection systems (e.g., guardrails, safety nets, etc.) are impractical and/or only administrative controls are feasible for certain tasks.

Is an Alternative Fall Protection Permit required?

☐ Yes ☐ No

Is an Alternative Fall Protection Permit attached to this Fall Protection Plan?

☐ Yes ☐ No

METHOD AND PROVISIONS FOR RESCUE WHEN WORKING AT HEIGHTS

Select one of the following two options below:

OPTION 1: Self-Rescue

SELF-RESCUE METHOD/PROCESS

OPTION 2: Assisted Rescue

Assisted rescue may be provided either by a professional rescue agency or by qualified company personnel. Select the appropriate choice below and complete the information contained in the tables below the selection. If both are used complete both sections and add additional information as necessary to clearly define the processes used.

☐ **Option 2A: Professional Rescue Agency Option**

PROFESSIONAL RESCUE AGENCY OPTION	
Rescue Agency (Name/Location)	
Contact Person (Name/Phone):	
Coordination Requirements Before Work:	
Method To Summon Help:	

☐ **Option 2B: Qualified Company Personnel Option**

QUALIFIED PERSONNEL RESCUE OPTION	
Qualified Training Agency/Company:	
Coordination Requirements Before Work:	
Method To Summon Help:	
Names of Rescue Persons	Job Classification Title
QUALIFIED AGENCY PROVIDING TRAINING AND CERTIFICATION	

AECOM Site/Location/Project Manager

Approved:

Print

Signature

Date

AECOM SH&E Manager

Approved:

Print

Signature

Date

AECOM Qualified and/or Competent Person

Approved:

Print

Signature

Date

Americas

Alternative Fall Protection Permit

S3NA-304-FM8

This completed Alternative Fall Protection Permit must be attached to its associated Fall Protection Plan.

LOCATION & TIME INFORMATION

Location & description of fall hazard:		Job Number:
Description of work to be done:		
Requestor(s) Name	Requestor(s) Title	

JUSTIFICATION FOR USING ADMINISTRATIVE CONTROLS

Confirm jurisdictional regulations permit administrative controls and state why more effective controls are impractical.

HAZARD IDENTIFICATION

Potential maximum fall distance:	
List any exposed hazards or objects that could be struck during a fall that would cause greater harm.	
Are there factors that could make this work more hazardous?	

FALL PROTECTION CONTROLS

Describe the fall protection strategy (safety-monitoring system, warning lines, etc.) and the associated limitations:

Safety Monitor (Competent Person) Name:

RESCUE INFORMATION & CONTACT

Phone number used to for rescue services:

QUALIFIED PERSON CERTIFICATION

I agree to, and certify the following:

- An on-site hazard assessment has been conducted and documented on this permit.
- Work described on this permit can be done safely.
- If work conditions or work requirements change, or hazards not previously identified are encountered, work will stop until a new permit is issued or the new hazards have been eliminated.
- This work will **not** be performed during inclement weather/rain.

Name (printed)

Signature(s)

Date / Time

PERMIT AUTHORIZATION

- All personnel performing work or designated as observers are trained in accordance with *S3NA-304-PR Fall Protection / Working at Heights* and *S3NA-003-PR1 SH&E Training*.
- More effective fall protection controls are impractical for reasons other than cost or convenience and the justification for working with only administrative controls is acceptable.
- Verbal approval has been secured from the Site/Location/Project Manager or Safety Manager.
- A pre-task briefing has been held which included all personnel involved with this work.

Authorized Start Date/Time for Permit:**Expiration Date/Time for Permit****(Not to exceed work shift)**

Date:

Time:

Date:

Time:

Name & Title of approving authority (Manager/Supervisor that is a Fall Protection Competent Person)

Name

Title

Date / Time

Signature(s)

Reviewed by (Name)

Signature

Safety Monitor:

**THIS PERMIT MUST BE POSTED WHERE THE WORK IS BEING PERFORMED.
THIS PERMIT EXPIRES AT THE END OF THE SHIFT ON WHICH IT WAS ISSUED.
A NEW PERMIT MUST BE ISSUED FOR WORK THAT CONTINUES INTO THE NEXT SHIFT.**

IN THE EVENT OF AN EMERGENCY CONTACT:

This completed Alternative Fall Protection Permit must be attached to its associated Fall Protection Plan.

Hand & Power Tools

S3AM-305-PR1

1.0 Purpose and Scope

- 1.1 This procedure provides the AECOM requirements for all manually operated hand and power tools and associated use, handling and storage. These requirements apply to tools provided by AECOM for employee use as well as tools provided by employees for use on AECOM work sites.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 None

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-118-PR1 Hearing Conservation
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM-302-PR1 Electrical Safety
- 3.5 S3AM-325-PR1 Lockout Tagout

4.0 Procedure

- 4.1 Roles and Responsibilities
 - 4.1.1 **Managers/Supervisors**
 - Ensure that all aspects of this procedure are followed and adhered to on all AECOM projects, sites and locations.
 - If a specific tool is not included in the work instructions related to this procedure, appropriate guidelines shall be established prior to work associated with that tool, including following manufacturer's recommendations.
 - Ensure compliance with applicable client requirements and restrictions regarding hand or power tools.
 - 4.1.2 **Safety, Health and Environment (SH&E) Manager**
 - Provide technical guidance and support as to this procedure and associated work instructions.
 - 4.1.3 **Employees**
 - Work only with tools for which they are appropriately trained and familiar with.
 - Follow manufacturer's recommendations for its use and never modify the equipment without first obtaining authorization from the manufacturer.
 - Comply with applicable client requirements and restrictions regarding hand or power tools.
- 4.2 Requirements
 - 4.2.1 Always conduct a task hazard assessment (THA) prior to work commencing and include the identified hazards associated with the anticipated tool use.
 - 4.2.2 No employee shall use any hand or power tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

- 4.2.3 All tools will be used for which they were designed and in accordance with manufacturer's specifications. Do not use tools for jobs they are not intended for. For example, do not use a slot screw driver as a chisel, pry bar, wedge or punch or wrenches as hammers.
- 4.2.4 Use approved tools only. Never modify or use makeshift tools.
- 4.2.5 Do not apply excessive force or pressure on tools unless permitted by the manufacturer's specifications. This includes additional force by hammering with body weight, foot or other tools.
- 4.2.6 Keep surfaces and handles clean and free of excess oil and grease to prevent slipping.
- 4.2.7 Do not carry sharp tools (e.g. knife, chisel, screwdriver, etc.) in pockets; this practice may cause puncture wounds.
- 4.2.8 All tools shall be properly maintained. Clean, dry, lubricate and repair tools as applicable, and return to a suitable toolbox, room, rack, or other storage area upon completion of a job.
- 4.2.9 Ensure proper ergonomics principles are observed when using hand and power tools, such as but not limited to:
 - Avoid static and awkward positions when possible.
 - Move at intervals to reduce muscle fatigue.
 - Consider tools with a trigger strip, rather than a trigger button. This strip will allow the exertion of more force over a greater area of the hand that, in turn, will reduce muscle fatigue
 - Do not apply excessive force or pressure on tools.
 - If possible use tools with comfortable grips that are designed to allow the wrist to stay straight. Avoid using a bent wrist.
 - Choose hand tools that have a centre of gravity within or close to the handle.
 - Frequently used tools that weigh more than 1 pound (0.45 kilograms) should be counter-balanced.
 - Ensure proper body positioning when using a tool to prevent slips or falls in the event of unanticipated tool behaviour (slip, kickback, etc.). Avoid over-reaching.
 - Pull on tools such as a wrench or pliers whenever possible. Loss of balance is more likely when pushing if the tool slips. If pushing is necessary, hold the tool with an open palm.
 - Hand-arm vibration exposure is associated with the use of hand tools.
 - Reduce power to the lowest setting that can complete the job safely. This action reduces tool vibration at the source.
 - Consider the need for controls such as limiting time of use.
 - If safe to do so, adjust to a looser but stable grip, and use anti-vibration gloves.
 - Use of heavy tools such as jackhammers can cause fatigue and strains. Heavy rubber grips can reduce these effects by providing a secure handhold.
 - Do not increase a tool's leverage by adding sleeved additions (e.g. a pipe or snipe) to increase tool handle length.
- 4.2.10 Avoid placing fingers and hands in danger zones:
 - Ensure hands and fingers have sufficient clearance in the event the tool slips.
 - Ensure stability of the work-piece. Use work-piece holders (e.g. vise, chisel holder, etc.) whenever possible to prevent injury to hands or deflection of tool or work-piece.
 - Use push sticks or guides when cutting or machining smaller material.

- 4.2.11 Secure tools when working from heights to prevent them from falling. Never leave tools on ladders, scaffolds, or overhead work areas when they are not in use.
- 4.2.12 Utilize good housekeeping practices to ensure tools do not present a tripping hazard.
- 4.2.13 Ensure no part of a tool extends over the edge of the bench top. Place sharp tools (e.g., saws, chisels, knives) on benches so that sharp points or edges face away from the edge.
- 4.2.14 When using saw blades, knives, or other tools, if possible direct the tools away from aisle areas and away from other employees working in close proximity.
- 4.2.15 Do not throw tools from place to place or from person to person, or drop tools from heights. Hand them, handle first, directly to other workers.
- 4.2.16 Use non-sparking and intrinsically safe tools in atmospheres with flammable or explosive characteristics and where highly volatile liquids, and other explosive substances are stored or used.
 - Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools made of non-ferrous materials shall be used.
 - Electrical tools shall be identified as intrinsically safe.
- 4.2.17 If the task presents electrical hazards, worker must be competent and use the appropriate insulated tools to perform work that includes the risk of electrical shock. Cushioned grip handles do not protect against electrical shock.
- 4.2.18 The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The exception to fire-resistant fluid involves all hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines. This hydraulic fluid shall be of the insulating type.
- 4.2.19 All tools designed to accommodate guards must have the guard(s) in place when the tool is in use. Do not modify, remove, or disable any machine guards.
- 4.2.20 Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.
- 4.2.21 Make provisions to prevent tools from automatically restarting upon restoration of power. Refer to *S3AM-325-PR Lockout Tagout*.
- 4.3 Training
 - 4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.
 - Assess the employee's training needs as per *S3AM-003-PR1 SH&E Training* procedure.
 - Refer to the applicable work instructions associated with this procedure for any additional training specifics.
 - Training shall include applicable manufacturer's recommendations and guidelines.
 - 4.3.2 Employees shall demonstrate knowledge and competency in the use, safe handling and maintenance of the applicable tool prior to operation.
- 4.4 Personal Protective Equipment (PPE)
 - 4.4.1 Utilize basic PPE appropriate to the task; gloves, safety-toed boots, hard hats and safety glasses with side shields. Refer to *S3AM-208-PR1 Personal Protective Equipment*.
 - 4.4.2 Ensure lockout devices (padlocks, multiple lock hasps, tags) are utilized as necessary. Refer to *S3AM-325-PR Lockout Tagout*.

- 4.4.3 Ensure PPE is appropriate to the work and use additional PPE as required (e.g. mono-goggles, hearing protection, respiratory protection, etc.).
 - Dual eye protection is required to be worn by any employee undertaking or within 3 ½ feet (1 meter) of a task that produces projected particles or material.
 - Head and face protection is recommended for employees working with pneumatic tools.
 - Noise hazard is associated with pneumatic and many other tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.
- 4.4.4 Screens shall also be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.
- 4.4.5 Refer to the applicable work instructions associated with this procedure for any additional specialized PPE.
- 4.5 Inspections
 - 4.5.1 All tools must be inspected prior to each use.
 - Any tool that is defective or has missing parts must not be used.
 - Every broken or defective tool must be tagged 'out of service' or 'do not use' and immediately removed from service.
 - Tagged tools will be returned to the supervisor for repair or replacement.
 - 4.5.2 All tools must be inspected to manufacture's specifications and according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly. Refer to *S3AM-305-FM1 Hand & Power Tool Maintenance Inventory* and *S3AM-305-FM2 Hand & Power Tool Inspection Report*.

5.0 Records

- 5.1 None

6.0 Attachments

- 6.1 [S3AM-305-ATT1 Chainsaw](#)
- 6.2 [S3AM-305-ATT2 Circular Saw](#)
- 6.3 [S3AM-305-ATT3 Cut Off Saw](#)
- 6.4 [S3AM-305-ATT4 Handheld Grinder](#)
- 6.5 [S3AM-305-ATT5 Impact Wrench](#)
- 6.6 [S3AM-305-ATT6 Nail Gun](#)
- 6.7 [S3AM-305-ATT7 Dustless Vacuum](#)
- 6.8 [S3AM-305-ATT8 Power Drill](#)
- 6.9 [S3AM-305-ATT9 Pressure Washer](#)
- 6.10 [S3AM-305-ATT10 Reciprocating Saw](#)
- 6.11 [S3AM-305-ATT11 Sander](#)
- 6.12 [S3AM-305-ATT12 Knives](#)

- 6.13 [S3AM-305-ATT13 Clearing & Grubbing Equipment](#)
- 6.14 [S3AM-305-ATT14 Pneumatic Tools](#)
- 6.15 [S3AM-305-ATT15 Manual Hand Tools](#)
- 6.16 [S3AM-305-ATT16 Small Engines](#)
- 6.17 [S3AM-305-ATT17 Electric & Battery Hand Tools](#)
- 6.18 [S3AM-305-FM1 Hand & Power Tool Maintenance Inventory](#)
- 6.19 [S3AM-305-FM2 Hand & Power Tool Inspection Report](#)

S3NA-305-FM1

[illegible]

Americas

Hand & Power Tool Inspection Report

S3NA-305-FM2

[illegible]

Chainsaw

S3AM-305-ATT1

1.0 Objective / Overview

- 1.1 Available in a variety of types and capacities, chainsaws are one of the most powerful, yet dangerous cutting tools available.
- 1.2 Working safely with a chain saw includes proper training, good body mechanics and felling technique, well-maintained equipment, and protective clothing.

2.0 Hazards

- 2.1 Improper operation (kickback – sudden and violent reverse movement of the saw)
- 2.2 Hand/arm vibration
- 2.3 Noise
- 2.4 Flying/falling debris
- 2.5 Sharp, moving blade
- 2.6 Defective tool

3.0 Safe Operating Guidelines

- 3.1 Only approved operators are permitted to operate a chainsaw.
- 3.2 Review manufacturer's operating manual, *S3AM-305-PR1 Hand & Power Tools*, and *S3AM-305-ATT16 Small Engines* for additional guidelines.
- 3.3 Inspect saws prior to use and periodically during use:
 - 3.3.1 A sharp chainsaw is safer than a dull one. Worn chains shall be replaced immediately.
 - 3.3.2 Keep the saw clean, lubricated, and adjusted.
 - 3.3.3 Inspect and test the chain brake, chain catch, throttle lock, handles and guards, all nuts and bolts, spark arrestor, and muffler and air filter.
 - 3.3.4 The chain tension should be properly adjusted and the carburetor tuned. The idle must be correctly adjusted; the chain should not move when the saw is in the idle mode.
 - 3.3.5 Ensure the saw is fitted with an inertia break and hand guard.
 - 3.3.6 Ensure the saw is fueled with the appropriate fuel type.
 - 3.3.7 Do not operate a chain saw that is damaged or improperly adjusted, or is not completely and securely assembled. If a chainsaw is defective, remove it from service, and tag it clearly "Out of service for repair" or "Do Not Use". Replace damaged equipment immediately – do not use defective tools "temporarily." DO NOT ATTEMPT FIELD REPAIRS.
- 3.4 Never "drop start" the saw (the saw is held in the air with one hand on the handlebar and the other on the pull cord) as no control is provided to prevent rotation of the saw back toward the user.
- 3.5 Ensure an appropriately sized fire extinguisher or fire-fighting equipment is readily available.
- 3.6 A chainsaw is not only dangerous to the operator but also to surrounding persons. Do not allow others in the area when chainsaws are operated.
- 3.7 Never operate a chain saw when fatigued.

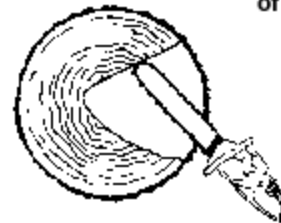
- 3.8 Make sure there are no nails, wire, or other imbedded material in the material to be cut that can cause flying particles or kickback.
- 3.9 Keep all parts of the body away from the saw chain when the engine is running.
 - 3.9.1 Keep the saw close to the body.
 - 3.9.2 Bend from the knees, not the waist. Improper lifting techniques and poor posture contribute to injuries.
 - 3.9.3 Always avoid standing on the log and making cuts with the saw between your legs; always cut with the saw to the outside of your legs.
 - 3.9.4 Always stand to one side of the limb to be cut, never straddle it.
 - 3.9.5 Never cut above chest height.
- 3.10 Determine where the tree/limb will fall prior to cutting.
 - 3.10.1 Start cutting only after a clear escape path has been made.
 - 3.10.2 Always ensure that personnel and equipment are not in the path of the falling tree/log, and that you have time to move away.
 - 3.10.3 If necessary, flag/or fence off the area to prevent entry.
- 3.11 Always keep in mind where the chain will go if it breaks; never position body or allow others in line with the chain.
- 3.12 Avoid operations that could result in kickback of the saw towards the operator.
- 3.13 Keep the chain out of the dirt, debris will fly, the teeth will be dulled and the chain life shortened.
- 3.14 Shut the saw off when carrying through brush or on slippery surfaces. The saw may be carried no more than 50 feet (15 meters) while idling.



Blade nose strikes another object



Improper starting of bore



Top or blade nose touches bottom or side of kerf during reinsertion

4.0 Personal Protective Equipment

- 4.1 Dual eye protection – safety glasses with side shields and a face shield
- 4.2 Chainsaw Chaps
- 4.3 Wear appropriate apparel. Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts.
- 4.4 Safety toe work boots
- 4.5 Hardhat with lateral impact protection
- 4.6 Gloves providing impact, abrasion, cut, tear, & puncture resistance
- 4.7 Hearing Protection

Americas

Circular Saw

S3NA-305-ATT2

1.0 Objective / Overview

- 1.1 The circular saw is used in cutting wood products (e.g. plywood, construction lumber, etc.).
- 1.2 Safe measures for use include proper training, good body mechanics and operating technique, well-maintained equipment, and protective equipment.

2.0 Hazards

- 2.1 Kickback – Sudden and violent reverse movement of the saw
- 2.2 Noise
- 2.3 Flying debris
- 2.4 Sharp, moving blade (severe cuts)
- 2.5 Defective tool
- 2.6 Improper operation



3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Use sharp blades and ensure cracked and dull blades are removed from service. Dull blades cause binding, stalling and possible kickback.
- 3.3 Use the correct blade for the application and check for proper operation before each cut.
- 3.4 Check often to ensure that guards return to their normal position quickly. Never defeat the guard to expose the blade.
- 3.5 Portable circular saws having a blade greater than 2 inches (5.08 centimeters) in diameter must be equipped at all times with guards. An upper guard must cover the entire blade of the saw.
- 3.6 A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work position.
- 3.7 Before starting a circular saw, be sure the power cord and extension cords are out of the blade path and are long enough to freely complete the cut. A sudden jerk or pulling on the cord can cause loss of control of the saw and a serious accident.
- 3.8 Secure the work being cut to avoid movement.
- 3.9 For maximum control, hold the saw firmly with both hands after securing the work piece.
- 3.10 Keep the upper and retracting lower blade guard and the motor free from dust.
- 3.11 Do not hold or force the retracting lower guard in the open position.
- 3.12 Do not over tighten the blade-locking nut.
- 3.13 Do not twist the saw to change, cut or check alignment.
- 3.14 Do not use a saw that vibrates or appears unsafe in any way.
- 3.15 Do not force the saw during cutting.
- 3.16 Do not cut materials without first checking for obstructions or other objects such as nails and screws.
- 3.17 Check frequently to be sure clamps remain secure.

- 3.18 Avoid cutting small pieces that can't be properly secured and material on which the saw shoe can't properly rest. Use a push stick or guide when cutting operation requires the hands of the operator to come close to the blade.
- 3.19 Do not overreach. Keep proper footing and balance.
- 3.20 When starting the saw, allow the blade to reach full speed before contacting the work piece.
- 3.21 Circular saws are designed for right-hand operation; left-handed operation will demand more care to operate safely.
- 3.22 Never place hand under or in front of the shoe or guard of the saw when operating.
- 3.23 Cut at the proper depth ($\frac{1}{4}$ inch / 0.64 centimeters) below work surface. Set the depth of the blade prior to use, when the saw is unplugged.

4.0 Personal Protective Equipment

- 4.1 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewelry can become caught in moving parts.
- 4.2 Gloves that provide cut, abrasion and impact resistance.
- 4.3 Kickback apron as necessary.
- 4.4 Safety toed boots.
- 4.5 Safety glasses with side shields and faceshield.
- 4.6 Hearing Protection.

Cut Off Saw

S3NA-305-ATT3

1.0 Objective / Overview

- 1.1 Cut-off saws are high-speed cutting tools and very dangerous to operate. Therefore, it is very important to review the general safety rules, training, Personal Protective Equipment and procedures for working with portable cut off saws.
- 1.2 Cut off saws are used in a variety of activities (i.e. concrete, piping, metal, etc.).

2.0 Hazards

- 2.1 Noise
- 2.2 Flying debris
- 2.3 Sharp, moving blades (severe cuts)
- 2.4 Ignition sources (hot engine, sparks)
- 2.5 Hand/arm vibration
- 2.6 Kickback – Sudden and violent reverse movement of the saw

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* or *S3NA-305-ATT16 Small Engines* for additional guidelines
- 3.2 In addition to inspecting the general tool prior to operation, inspect the abrasive wheel for cracks and chips and appropriate wheel type.
 - 3.2.1 If cracked or chipped, replace wheel before use.
 - 3.2.2 Do not use abrasive-type wheels for rough grinding.
- 3.3 Ensure the saw is started in accordance with manufacturer's specifications:
 - 3.3.1 Start the saw on firm ground or other solid surface in an open area.
 - 3.3.2 Never "drop start" the saw as in the above picture (the saw is held in the air with one hand on the handlebar and the other on the pull cord) as no control is provided to prevent rotation of the saw back toward the user.
- 3.4 Handling
 - 3.4.1 Hold the saw firmly with two hands when the engine is running, and whenever the blade is rotating until it comes to a complete stop.
 - 3.4.2 Carry the saw with engine stopped, muffler away from your body, while protecting the cutting wheel from striking the ground or other objects.
- 3.5 Cutting
 - 3.5.1 Clear the working area.
 - 3.5.2 Begin cutting at full throttle and continue at full throttle until the cut is finished.
 - 3.5.3 Avoid standing in a direct line with the cutting wheel.
 - 3.5.4 Use only downward pressure on the saw, as lateral pressure may cause the blade to break and shatter.

- 3.5.5 Do not change the direction of the cut once started, as this can also cause the blade to break and shatter.
- 3.5.6 Do not cut above shoulder height.
- 3.5.7 Avoid operating the saw if the terrain is wet and/or frozen.
- 3.5.8 Keep flammable and combustible materials away from saw while cutting.
- 3.5.9 Ensure an appropriate fire extinguisher or fire-fighting equipment is readily available.
- 3.6 Maintenance
 - 3.6.1 Shut off the engine and remove the spark plug wire before adjusting or working on the saw.

4.0 Personal Protective Equipment

- 4.1 Safety glasses with side shields and faceshield.
- 4.2 Chainsaw chaps.
- 4.3 Safety toe work boots.
- 4.4 Gloves that provide cut abrasion and impact resistance.
- 4.5 Hearing protection: earplugs and/or earmuffs.
- 4.6 Respirator if required (concrete operations).

Americas

Handheld Grinder

S3AM-305-ATT4

1.0 Objective / Overview

- 1.1 Handheld grinders are high-speed electric- or pneumatic-powered grinding tools used to shape or cut metal, and can be dangerous to operate.
- 1.2 Grinders are used in a variety of activities (i.e., piping installation/repair, metal, restoring, polishing, sharpening, etc.).

2.0 Potential Hazards

- 2.1 Kickback – Sudden and violent reverse movement of the grinder
- 2.2 Electric shock
- 2.3 Flying debris
- 2.4 An improperly installed or incompatible wheel can break or explode and cause injury.
- 2.5 Moving parts (severe cuts)
- 2.6 Fire hazard from sparks igniting nearby debris or objects
- 2.7 Noise
- 2.8 Hand/arm vibration

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3AM-305-PR1 Hand & Power Tools*, and *S3AM-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Inspect the tool before every use. Damaged tools must be removed from use and tagged "DO NOT USE".
- 3.3 Grinder guards are to be used at all times and must not be altered.
 - 3.3.1 US requirements specify a maximum of 180° of the grinding wheel to be exposed.
 - 3.3.2 While 120° coverage may be permissible in certain jurisdictions, guards that are greater are not to be cut down.
 - 3.3.3 Replace damaged or defective guards immediately
- 3.4 Grinders must be used with an unmodified manufacturer supplied handle at all times. If removal of the handle is required the reason must be appropriately documented and approved by project / location manager and SH&E manager or designee. Client approval may also be required.
- 3.5 Trigger locks are not permitted. If a grinder is found with a trigger lock, the lock shall be disabled.
- 3.6 Never use the grinder for jobs for which it is not designed (e.g. cutting with a grinding wheel vs. cutting disc).
- 3.7 Grinders must be permanently marked with the manufacturer's established maximum RPM (revolutions per minute).
- 3.8 Inspect the disk or wheel prior to operation:
 - 3.8.1 Wire wheels must be inspected for loose and broken wires.



- 3.8.2 Ensure the RPM (as posted on the wheel) is equal to or greater than that posted on the grinder, the disk / wheel is the correct size for the grinder, and the type of wheel is compatible with the material being ground or cut.
- 3.8.3 Wheels must be replaced as specified by the manufacturer. In the absence of specifications a wheel shall not be worn down to a size which would allow the mounting flange assembly to contact the work-piece or work-piece holding fixture.
- 3.8.4 Ensure the disk or wheel is checked for cracks or other damage. A ring test can be conducted on clean, dry, unmounted wheels greater than 4" (10.16 centimeters) in diameter:
 - Suspend the wheel by its arbor hole;
 - Use a non-metallic tool (wood, plastic) to gently tap the wheel at 45° from the vertical center line on either side of the wheel, approximately 1 to 2 inches (2.5 – 5 centimeters) from the edge;
 - Rotate the wheel 45° and repeat the process until the entire wheel has been tested;
 - A wheel that emits a metallic ring indicates absence of damage, whereas a dull sound means the wheel should be removed from service.
- 3.8.5 If cracked, chipped, or there is any other evidence of damage, remove from service and replace wheel before use.
- 3.9 When mounting the wheels:
 - 3.9.1 Grinders must be unplugged before changing wheels, discs or positioning guards.
 - 3.9.2 Follow manufacturer's specifications (e.g. stamp facing grinder, mount up, mount down, etc.)
 - 3.9.3 Ensure that the mounting flanges are clean and the mounting blotters are used.
 - 3.9.4 Do not over tighten the mounting nut.
 - 3.9.5 Before grinding or cutting, run newly mounted wheels at operating speed to check for vibrations.
- 3.10 General Safety Provisions
 - 3.10.1 Ensure abrasive wheels are stored according to manufacturer specifications (absence of temperature extremes and solvents, dry area protected from impact, first in first out).
 - 3.10.2 Keep the work area clean. Do not grind near flammable and combustible materials. Sparks can ignite debris and flammable vapors. A fully charged fire extinguisher must be located nearby. Use of a fire blanket may be necessary.
 - 3.10.3 All observers should be kept at a safe distance from the work area to ensure they are protected from flying debris / sparks. Whenever practicable, use screens or shields.
 - 3.10.4 Always secure work with clamps or a vise, freeing both hands to operate the tool. Never clamp a handheld grinder in a vice.
 - 3.10.5 Use grinding wheels only at their rated speed.
 - 3.10.6 Ensure safety guard(s) is positioned properly prior to start-up.
 - 3.10.7 Allow the grinder to come to full operating speed before beginning grinding operation.
 - 3.10.8 Do not use the side of a grinding wheel unless the wheel is designed for side grinding.
 - 3.10.9 Always stand to the side of the wheel, never directly behind it.
 - Be sure to keep your footing and maintain proper balance. Keep hands, fingers, and other body parts from coming into contact with the revolving wheel.
 - While in operation, grinder shall be held with a firm grip using both hands. One engaging the trigger, and the second holding the handle.

3.10.10 Grinding aluminum is prohibited.

3.10.11 Tools shall be maintained with care. They should be kept clean and sharp for the best performance. Follow instructions in the user's manual for lubricating and care instructions.

4.0 Personal Protective Equipment (PPE)

- 4.1 Please refer to *S3AM-208-PR1 Personal Protective Equipment* for further information.
- 4.2 Gloves providing appropriate heat, impact, abrasion, cut, tear, & puncture resistance.
- 4.3 Wear appropriate apparel. Long-sleeved shirts and pants are required; clothing shall be made of natural fibers. Synthetics are not permitted. Note: Long hair, loose or baggy clothing, hoodie strings, ties, or jewelry can become caught in moving parts.
- 4.4 Dual eye protection required - Safety glasses with sideshields and properly impact-rated face shield. Welding helmets used as a face shield shall be verified as approved by CSA / ANSI for protection against impact.
- 4.5 Safety toe work boots.
- 4.6 Hearing protection: earplugs and/or earmuffs.
- 4.7 Other PPE as necessary for the work site/activity (e.g., hard hat, respiratory protection).

Impact Wrench

S3NA-305-ATT5

1.0 Objective / Overview

- 1.1 Impact wrenches are mainly used for tire changing but that does not limit their use. They can be used in all applications when a certain amount of torque is needed to loosen or tighten nuts and bolts.
- 1.2 The danger comes in to play when employees try to use the wrong sockets with an air wrench. Employees using air wrenches must have a general understanding of how to use them.

2.0 Potential Hazards

- 2.1 Flying debris
- 2.2 Noise
- 2.3 Cuts
- 2.4 Hand/arm vibration

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT14 Pneumatic Tools* for additional guidelines.
- 3.2 Impact wrench sockets and accessories must be used with this tool. Do not use hand sockets and accessories.
- 3.3 The proper fastening torque may differ depending upon the kind or size of the bolt.
- 3.4 Check the torque with a torque wrench.
- 3.5 Connect tool to air hose of recommended size.
- 3.6 Never use a wire, soft pin, or nail to hold the socket onto the square spindle of the impact wrench.
- 3.7 If the proper retaining device on the tool is broken, the tool shall be removed from service to be repaired.
- 3.8 On applications where a low or critical level of torque is required, it is recommended that each fastener is impacted lightly. Then perform the final tightening with a hand torque wrench.

4.0 Personal Protective Equipment

- 4.1 Safety toed boots
- 4.2 Anti-vibration gloves with impact and abrasion and cut resistance.
- 4.3 Safety glasses with side shields.
- 4.4 Hearing protection.

Nail Gun & Stapling Tool

S3NA-305-ATT6

1.0 Objective / Overview

- 1.1 Nail guns and stapling tools (pneumatic power-fastening devices) are useful, but must be handled with care.
- 1.2 Nail guns and stapling tools have been shown to be the cause of unnecessary injuries when the design of the gun places emphasis on speed, rather than safety.

2.0 Potential Hazards

- 2.1 Flying debris/nails
- 2.2 Imbedded object
- 2.3 Puncture wounds
- 2.4 Noise

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT14 Pneumatic Tool* for additional guidelines.
- 3.2 Permit only experienced and trained persons to operate pneumatic nailing and stapling tools. Never let an inexperienced worker use a nail gun without supervised training.
- 3.3 Never point a nail gun or stapling tool toward the body or any other personnel.
 - 3.3.1 Never rest the gun against any part of your body, or try to climb a ladder with the gun cradled against your body.
 - 3.3.2 Be aware of other workers in the work area.
 - 3.3.3 Be aware of what is located behind the nailing surface. Never place hands or other body parts directly behind the nailing surface.
 - 3.3.4 Ensure no one is in the line of fire should an incorrectly selected fastener eject out the other side of the material.
- 3.4 Inspect a tool before connecting it to air supply:
 - 3.4.1 Check tool safety mechanisms if applicable. Never disable a safety tip on a nail gun or stapling tool.
 - 3.4.2 Tighten securely all screws and cylinder caps.
 - 3.4.3 Pneumatic power-fastening devices that shoot nails, rivets, staples, or similar fasteners and operate at pressures more than 100 pounds per square inch (6,890 kPa), must be equipped with a safety interlock to keep fasteners from being ejected, unless the muzzle is pressed against the work surface.
- 3.5 Check correct air supply and pressure before connecting a tool.
- 3.6 Check that the tool is correctly and securely connected to the air supply hose and that it is in good working order, with the safety mechanism operative, before using.
- 3.7 Always handle a tool as if it loaded with fasteners (nails, staples, etc.). Do not carry a tool with a finger on the trigger or with the trigger depressed.
- 3.8 Equip tools with a work-contacting element that limits the contact area to one that is as small as practical.
- 3.9 Make sure that the mechanical linkage between the work-contacting element and trigger is enclosed.

- 3.10 Disconnect a tool from the air supply and ensure the air is completely exhausted from the tool when the tool is unattended, when loading with fasteners (nails, staples), and during cleaning or adjustment.
- 3.11 Before clearing a blockage, be sure that depressing the trigger exhausts all air from the tool and the tool is disconnected from the air supply.
- 3.12 Use only fasteners recommended by the manufacturer. Ensure fasteners are appropriate to the work surface to ensure fastener does not eject completely through the material.
- 3.13 Avoid nailing into knots as nail can splinter wood.
- 3.14 Permit only properly trained people to carry out tool maintenance.
- 3.15 Do not depress the trigger unless the nosepiece of tool is directed onto a safe work surface and properly aligned both vertically and horizontally with the surface
- 3.16 Do not overreach. Keep proper footing and balance.
- 3.17 Ensure the hand not holding the nail gun or stapling tool is a minimum of 12 inches (30cm) away from the nosepiece of the tool.
- 3.18 Keep the gun properly aligned with your work both vertically and horizontally.

4.0 Personal Protective Equipment

- 4.1 Gloves providing appropriate protection to the task (e.g. impact, puncture, chemical, etc.).
- 4.2 Safety toed boots.
- 4.3 Use hearing protection, where required.
- 4.4 Wear safety glasses with side shields at all times and face shield if flying debris may be encountered.

Americas

Dustless Vacuum

S3NA-305-ATT7

1.0 Objective / Overview

- 1.1 Dustless decontamination system (also referred to as Pentek brand name) removes and packages surface contamination from concrete and steel structures.
- 1.2 The Pentek integrated suite of manually operated equipment (e.g., squirrel III, corner cutter, roto-peen, and crack chaser) is designed for the safe removal of radioactive materials, lead-based paints, polychlorinated biphenyls, pesticides, chemical residues, and other contaminated coatings.
- 1.3 The Pentek system incorporates a high-performance vacuum and waste packaging unit, the VAC-PAC, in conjunction with pneumatically operated equipment to remove contaminated material. Dust and debris are captured at the cutting tool surface. Supporting equipment required to operate the unit includes a 60 kilowatt generator and an air compressor (minimum 350 cubic feet capacity), as well as a drum grapple for drum handling activities.

2.0 Hazards

- 2.1 Noise
- 2.2 Vibration
- 2.3 Tripping
- 2.4 Hot surfaces (vacuum unit)
- 2.5 Electrical (high voltage)
- 2.6 Pinch
- 2.7 Back strain
- 2.8 High pressure air

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT14 Pneumatic Tool* for additional guidelines.
- 3.2 Prior to use, a pre-operation inspection must be completed to determine if the unit is in safe working condition.
- 3.3 The vacuum unit should be placed a minimum of 50 feet (15.2 meters) away from the work area.
- 3.4 Once in position to begin work, apply the brake to stabilize the unit. When raising the VAC-PAC to insert/remove a drum, do not place your body or any extremity under the VAC-PAC while it is in the raised position.
- 3.5 Two workers should be used to maneuver the unit into place.
- 3.6 A minimum 10 feet (3 meters) clearance will be established around the unit while in operation.
- 3.7 Workers should be aware of their position in relation to the hoses and cable to minimize tripping hazards.
- 3.8 A competent person will train each worker in the operation of the unit.
- 3.9 Maintenance in excess of preventive maintenance activities (e.g., lubrication) will be performed by manufacturer personnel ONLY. Always know where the emergency stop is located.
- 3.10 Operators of a motorized drum grapple must be trained in agreement with the powered industrial truck

standard. Refer to *S3NA-324-PR1 Powered Industrial Trucks*.

- 3.11 Review *S3NA-302-PR1 Electrical Safety* prior to refueling the electrical generator and/or compressor.

4.0 Personal Protective Equipment

- 4.1 Leather gloves (maintenance).
- 4.2 As applicable, Tyvek suit (with hood).
- 4.3 Anti-vibration gloves (operation).
- 4.4 Hearing protection (plugs or muffs).

Power Drill

S3NA-305-ATT8

1.0 Objective / Overview

- 1.1 Available in a variety of types and capacities, portable power drills are undoubtedly the most used power tools.
- 1.2 Because of their handiness and application to a wide range of jobs, drills often receive heavy use. For this reason, you will need to carefully check your drill's capacity limitations and accessory recommendations.

2.0 Hazards

- 2.1 Electricity
- 2.2 Flying debris
- 2.3 Rotating and sharp parts
- 2.4 Burns (hot bits)
- 2.5 Manual handling (sprains/strains - wrist)

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Always keep drill bits sharp.
- 3.3 Disconnect the power supply before changing or adjusting bit or attachments,
- 3.4 Do not use high speed steel (HSS) bits without cooling or using lubrication.
- 3.5 Be sure the chuck is tightly secured to the spindle. This is especially important on reversible-type drills. Tighten the bit securely as described by the owner/operators manual.
- 3.6 The chuck key must be removed from the chuck before starting the drill. A flying key can be an injury-inflicting missile.
- 3.7 Secure workpiece being drilled to prevent movement.
- 3.8 If the bit is long enough to pass through the material, select a shorter drill bit or provide against damage and injury.
 - 3.8.1 Prevent other workers from accessing the area.
 - 3.8.2 Remove or provide coverage for material that could be damaged by the drill bit.
- 3.9 Secure magnetic drills with a chain or rope to prevent falling. Label cord connections to prevent unplugging.
- 3.10 Check auxiliary handles, if part of the tool. Be sure they are securely installed.
- 3.11 Always use the auxiliary drill handle when provided. It gives you more control of the drill, especially if stalled conditions occur.
- 3.12 Grasp the drill firmly by insulated surfaces.
- 3.13 Always hold or brace the tool securely. Brace against stationary objects for maximum control. If drilling in a clockwise -- forward -- direction, brace the drill to prevent a counter-clockwise reaction.
- 3.14 Do not overreach. Always keep proper footing and balance.
- 3.15 Don't force a drill. Apply enough pressure to keep the drill bit cutting smoothly. If the drill slows down, relieve

the pressure. Forcing the drill can cause the motor to overheat, damage the bit and reduce operator control.

4.0 Personal Protective Equipment

- 4.1 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts.
- 4.2 Gloves that provide cut, abrasion and impact resistance.
- 4.3 Safety toed boots.
- 4.4 Safety glasses with side shields and face shield.
- 4.5 Hearing protection.

Pressure Washer

S3NA-305-ATT9

1.0 Objective / Overview

- 1.1 Pressure washing can be divided into three categories based on the water pressure the equipment is capable of producing:
- Ultra high pressure jetting – greater than 30,000 psi
 - High pressure washing – 5,000 to 30,000 psi
 - Pressure washing – less than 5,000 psi
- 1.2 Generally, light duty portable pressure washing equipment and car washes produce less than 5,000 psi. High pressure washing equipment is often used for such tasks as cleaning vessels and process piping. Ultra high pressure jetting is also often employed to clean vessels and to remove coatings and scaling of production equipment. If not used correctly and safely, pressure washers can be dangerous piece of work equipment.
- 1.3 AECOM only allows trained, authorized personnel to operate the high pressure washers. Along with training, other safety measures include: reviewing the manufacturers instructional booklet, proper maintenance of equipment, and personal protective equipment.

2.0 Hazards

- 2.1 Kickback – Sudden and violent reverse movement of the gun
- 2.2 Flying debris
- 2.3 Slips and trips on wet surfaces and hoses
- 2.4 Noise
- 2.5 Manual handling
- 2.6 Exhaust fumes/carbon monoxide (CO) in enclosed spaces
- 2.7 Contact with high pressure / high temperature fluids

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, *S3NA-305-ATT17 Electric & Battery Hand Tools* or *S3NA-305-ATT16 Small Engines* for additional guidelines.
- 3.2 Ensure area is properly flagged with tags identifying work being performed and hazards. Keep all unauthorized workers out of area while job in progress.
- 3.3 Inspect all hoses, fittings, wands, cords and hose reel for damage or defects.
- 3.3.1 Equipment is complete and assembled correctly (i.e. nozzle tip correctly connected to the wand and not directly to hose).
 - 3.3.2 Ensure trigger mechanism is functioning properly.
 - 3.3.3 Fittings are securely attached.
 - 3.3.4 Insulated components are in place.
- 3.4 Check fuel connections and hoses for signs of leaks, defects or damage.
- 3.5 Confirm nozzle / jets are clear by turning on water, without pump pressure.

- 3.6 Check pressure pump oil level before use. Hold the wand firmly with the trigger released when turning the pump on.
- 3.7 Recheck hoses once the system is pressurized.
- 3.8 Never service equipment while energized or pressurized.
- 3.9 Ensure other personnel are clear of area while pressure washer is pressurized. Non-operators must remain a minimum of 25 feet (7.6m) from the operator.
- 3.10 Do not wash at a 90 degree angle to minimize spray and flying debris.
- 3.11 Never point a pressure washer at yourself or others. Contact with high pressure fluid can result in serious cut or injection injuries.
- 3.12 Increase pressure slowly during operation to prevent hose kick-back.
- 3.13 Do not drive over, pull on, or kink the high pressure hose. Damage to the hose may compromise the wire braiding inside and cause the hose to burst.
- 3.14 Whip checks must be used for all high pressure connections.
- 3.15 High-pressure washing equipment should be cleaned often to avoid dirt buildup, especially around the trigger and guard area.
- 3.16 Always set the trigger safety lock when the gun valve is not in use.
- 3.17 Relieve the pressure in the system before coupling and uncoupling hoses.
- 3.18 Visually inspect the full length of high pressure discharge hose and inspect other high pressure fluid-handling components for abrasions or cuts, damage caused by exposure to chemicals and for damage caused by kinks in the hose.
- 3.19 High pressure washers shall be used to clean or decontaminate equipment, surfaces or structures only.
- 3.20 High pressure washers WILL NOT be used to clean or decontaminate workers or personal protective equipment while it is being worn.
- 3.21 Maintain a distance from the spray contact point to reduce noise exposure and risk of being struck by flying debris. Avoid overreaching and maintain a stable stance.
- 3.22 When shutting down a pressure washer, turn the pump off before turning the water supply off.
- 3.23 After turning off pressure washer, ensure all residual pressure is released from system by squeezing the trigger. Consult the operator's manual for any other procedures specific to the equipment for shut-down.
- 3.24 Protect unit from freezing, when applicable.

4.0 Personal Protective Equipment

- 4.1 Hardhat.
- 4.2 Safety glasses with side shields and a face shield.
- 4.3 Gloves providing appropriate protection (rubber, chemical).
- 4.4 Hearing protection.
- 4.5 PVC (or equivalent) rain suit.
- 4.6 Safety toed boots with metatarsal protection.

Reciprocating Saw

S3NA-305-ATT10

1.0 Objective / Overview

- 1.1 The versatility of the reciprocating saw, in cutting metal, pipe, wood and other materials have made it a widely used tool.
- 1.2 By design, it is a simple tool to handle. Its demands for safe use, however, are very important.

2.0 Potential Hazards

- 2.1 Flying debris
- 2.2 Noise
- 2.3 Sharp, moving parts (cuts)
- 2.4 Hand/arm vibration
- 2.5 Electricity

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Use sharp blades. Dull blades can produce excessive heat, make sawing difficult, result in forcing the tool, and possibly cause an accident.
- 3.3 Ensure appropriate blade selection. Different work surfaces demand different blades
- 3.4 Position yourself to maintain full control of the tool, and avoid cutting above shoulder height. Always use two hands to operate the saw.
- 3.5 To minimize blade flexing and provide a smooth cut, use the shortest blade that will do the job.
- 3.6 The work piece must be clamped securely, and the shoe of the saw held firmly against the work to prevent operator injury and blade breakage.
- 3.7 Maintain firm contact between the saw's shoe and the material being cut.
- 3.8 When making a "blind" cut (cannot see behind what is being cut), be sure that hidden electrical wiring, or water pipes are not in the path of the cut.
- 3.9 If wires are present, they must be disconnected at their power source by a qualified person or avoided, to prevent the possibility of lethal shock or fire.
- 3.10 Water pipes must be drained and capped.
- 3.11 Always hold the tool by the insulated grouping surfaces. When making anything other than a through cut, allow the tool to come to a complete stop before removing the blade from the work piece. This prevents breakage of the blade, and possible loss of tool control. Do not operate reciprocating saw in explosive atmospheres.
- 3.12 Do not overreach. Keep proper footing and balance at all times.
- 3.13 Check for misalignment or binding of moving parts, breakage or parts and any other condition that may affect the tool's operation.

4.0 Personal Protective Equipment

- 4.1 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewelry can become caught in moving parts.
- 4.2 Gloves that provide cut abrasion and impact resistance.
- 4.3 Kickback apron, as necessary.
- 4.4 Safety toed boots.
- 4.5 Safety glasses with side shields and face shield.
- 4.6 Hearing protection.

Sander

S3NA-305-ATT11

1.0 Objective / Overview

- 1.1 Sanders are commonly used at project sites for a variety of tasks.
- 1.2 Often times the hazards associated with sanders are overlooked; they don't appear threatening because they don't have sharp blades or bits. These misconceptions can be prevented through proper training and personal protective equipment (PPE) selection.

2.0 Potential Hazards

- 2.1 Kickback – Sudden and violent reverse of the sander
- 2.2 Noise
- 2.3 Hand/arm vibration
- 2.4 Dust exposure
- 2.5 Flying debris
- 2.6 Severe abrasive parts
- 2.7 Electricity
- 2.8 Fuel (fine dust) and ignition sources (electricity, friction)

3.0 Safe Operating Guidelines

- 3.1 Review manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Disconnect power supply before changing a sanding belt, making adjustments, or emptying dust collector.
- 3.3 Inspect sanding belts before use. Replace those belts that are worn or frayed.
- 3.4 Install sanding belts that are the same widths as the pulley drum.
- 3.5 Adjust sanding belt tension to keep the belt running true and at the same speed as pulley drum.
- 3.6 Secure the sanding belt in the direction shown on the belt and the machine. Keep hands away from the sanding belt.
- 3.7 Before starting a sander, be sure the power cord and extension cords are out of the belt path and are long enough to freely complete the task. The sander must be either double insulated or connected to a ground fault circuit interrupter.
- 3.8 Use two hands to operate sanders – one on the trigger and the other on the front handle knob. Move sanders away from the body.
- 3.9 Clean dust from the motor and vents at regular intervals.
- 3.10 Do not use a sander without an exhaust system or dust collector present that is in good working order. The dust created when sanding can be a fire and explosion hazard. Proper ventilation is essential as well as guarding against open flame and sparks.
- 3.11 Empty the collector when ¼ full. Minimise dust disturbance when emptying the collector.
- 3.12 Do not exert excessive pressure on a moving sander. The weight of the sander provides adequate pressure for the job.

- 3.13 Do not work on unsecured stock unless it is heavy enough to stay in place. Clamp the stop into place or use a 'stop block' to prevent movement.
- 3.14 Do not overreach. Always keep proper footing and balance.
- 3.15 Do not cover air vents of the sander.
- 3.16 Check often to ensure that guards are in their normal position.

4.0 Personal Protective Equipment

- 4.1 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts.
- 4.2 Gloves that provide cut, abrasion and impact resistance.
- 4.3 Safety toed boots.
- 4.4 Safety goggles and faceshield.
- 4.5 Hearing protection.
- 4.6 Respiratory protection, as necessary.

Knives

1.0 Objective / Overview

- 1.1 Knives serve a variety of purposes at work sites, and can be a useful tool, when used safely and correctly.
- 1.2 Learning proper positioning and correct use of a knife will drastically reduce the potential of cut-related injuries.

2.0 Hazards

- 2.1 Improper body positioning
- 2.2 Improper knife selection
- 2.3 Defective knife
- 2.4 Improper knife operation (including storage)

3.0 Safe Operating Guidelines

- 3.1 Select the appropriate knife for the task. Consider using a rounded tip blade if the task allows.
- 3.2 Always be sure that knives are sharp and not dull. A dull blade will require more force to cut, increasing the likelihood of injury (e.g. hand slipping, knife breaking, etc.). Replace dull blades – A knife that tears rather than cuts, generally indicates the blade is dull.
- 3.3 Be sure the blade is seated in the frame of the knife correctly, closed, and fastened together properly.
- 3.4 Always direct the cut away from yourself and others
 - 3.4.1 Keep body parts away from the cut line, (e.g., fingers, leg, etc.)
 - 3.4.2 Ensure that the material being cut is stabilized and not against a body part (e.g. cutting rope against your leg).
 - 3.4.3 Always pull the knife, never push the knife (the blade may break, and momentum could cause the body to come into contact with broken blade).
- 3.5 Ensure knife blades are protected or retracted when not in use.
 - 3.5.1 Never carry a knife with an exposed blade in your pocket.
- 3.6 Use of razor and break away utility knives is prohibited.
 - 3.6.1 Purchase safety-equipped utility knives with guarding or automatically retracting blades.
- 3.7 When using a knife to cut thicker materials, use several passes. Increased force on the blade can cause it to stray from the intended cut path, or break the blade.
- 3.8 When changing blades, always handle from the non-sharp side. Cover blade with duct tape and dispose.
- 3.9 Use an alternate tool when possible (scissors, wire cutters, etc.).
- 3.10 Let a falling knife fall.

4.0 Personal Protective Equipment

- 4.1 Cut resistant gloves are mandatory when using knives (Kevlar, thick leather, etc.).

Americas

Clearing & Grubbing Equipment

S3NA-305-ATT13

The following safety precautions will be followed during site clearing and tree falling.

1.0 General

- 1.1 Refer to *S3NA-305-PR1 Hand & Power Tools* for additional guidance.
- 1.2 As applicable, refer also to *S3NA-305-ATT15 Manual Hand Tools*, *S3NA-305-ATT16 Small Engines*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidance.
- 1.3 All clearing activities shall terminate during electrical storms and periods of high winds.
- 1.4 Dead, broken or rotted limbs or trees (widow makers) shall be felled first.
- 1.5 Be aware of the presence of other personnel when using any tool, especially picks or axes.

2.0 Machete, Pick and Axe Use

- 2.1 A machetes, picks and axes will only be used for their designated purpose; do not carelessly swing the tool when it is not needed.
- 2.2 To prevent lacerations, employees will wear Kevlar gloves and Kevlar chain saw chaps.
- 2.3 Machetes, picks and axes shall not be used when other employees are in the immediate work area.

3.0 Use of Weed Whips

- 3.1 Weed whips may be used to clear vegetation such as grass, light brush, briars and tree seedlings. The L-shaped weed whip cuts grass and weeds but is unstable for use on larger growth; the triangular-frame weed whip cuts briars and woody stems up to a half-inch in diameter. A "Suwannee" sling is a heavy duty weed whip that also has an axe blade. It does the same work as a weed whip, but can also cut through large materials. The heavier weight of this tool allows it to more easily cut off larger material than a weed whip.
- 3.2 When using weed whips, employees should follow these safety procedures:
 - 3.2.1 Select the correct tool for the types and size of vegetation present across the landfill.
 - 3.2.2 Employees will wear gloves that provide impact, abrasion, cut, tear, and puncture resistance when using weed whips.
 - 3.2.3 Weed whips are meant to be swung back and forth with both hands. Avoid using a golf swing. The tool should be swung no higher than an employee's side.
 - 3.2.4 Strong swings should be made to prevent the blade from bouncing or glancing off springy growth.
 - 3.2.5 Screws hold the serrated double-edge blade in place. These screws can work loose so check them before each use.
 - 3.2.6 At the end of the day, inspect the whips for damage. Clean, sharpen, and oil as necessary and store with a sheath in place.

4.0 Chain Saws

- 4.1 Refer to *S3NA-305-ATT1 Chainsaw*.

5.0 Felling Trees Manually

- 5.1 Before cutting begins, survey the work area for dead limbs, the lean of the tree to be cut, wind conditions and the location of other trees.

- 5.2 Remove lodged trees (tree has not fallen to the ground after being separated from its stump) as soon as possible. Never work under a lodged tree.
- 5.3 The distance between workers should be maintained at twice the height of the trees being felled.

6.0 Chipping Operations

- 6.1 Prior to use, make sure all safety devices and controls, such as emergency shut-off devices, are tested and verified to be functioning properly.
- 6.2 Access covers and doors shall not be opened until the drum or disk is at a complete stop.
- 6.3 Infeed and discharge ports shall be designed to prevent employee contact with disc, knives and blower blades.
- 6.4 The operator must be completely familiar with the controls and proper use of the equipment.
- 6.5 Workers feeding material into self-feeding wood chippers are at risk of being fed through the chipper if they reach or fall into the infeed hopper or become entangled in branches feeding into the machine.
 - 6.5.1 Make sure two workers (buddy system) are in close contact with each other when operating the chipper.
 - 6.5.2 Stand to the side of the chipper while inserting limbs into chipper, never stand directly in front.
 - 6.5.3 Insert trunk portion of tree/limb first. This will prevent the branches from getting entangled with clothing, etc. and pulling you in with the tree/limb.
 - 6.5.4 Bystanders should be kept at least 25 feet (7.6m) away when in operation.
 - 6.5.5 Keep the area around the wood chipper free of tripping hazards.
- 6.6 Never wear loose clothing that may get caught on feed material or moving parts.

7.0 Personal Protective Equipment

- 7.1 Wear proper apparel for the task.
 - 7.1.1 Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts.
 - 7.1.2 Wear clothing with long sleeves and full length pants of durable material.
- 7.2 Use gloves that provide impact, abrasion, cut, tear and puncture resistance.
- 7.3 Safety toed boots with ankle support.
- 7.4 Safety glasses with side shields and face shield.
- 7.5 Hearing protection as necessary.

Pneumatic Tools

S3NA-305-ATT14

1.0 Objective / Overview

- 1.1 Pneumatic tools utilize air pressure to perform the tool's task.
- 1.2 Safe measures for use include proper training, good body mechanics and operating technique, well-maintained equipment, and protective equipment.
- 1.3 There are several dangers associated with the use of pneumatic tools. First and foremost is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool.

2.0 Hazards

- 2.1 Improperly secured air hoses
- 2.2 Noise
- 2.3 Flying debris
- 2.4 Defective tool
- 2.5 Improper operation

3.0 Safe Operating Guidelines

- 3.1 Review the manufacturer's operating manual, *S3NA-305-PR1 Hand & Power Tools*, and *S3NA-305-ATT17 Electric & Battery Hand Tools* for additional guidelines.
- 3.2 Never use bottled gas as a power source for pneumatic tools.
- 3.3 Drain water from air compressor tank and condensation from air lines.
 - 3.3.1 Blow out the air line before connecting a tool. Hold hose firmly and blow away from yourself and others.
- 3.4 Pneumatic tools must be checked to see that the tools are fastened securely to the air hose to prevent them from becoming disconnected. Pneumatic tools must have the air supply controlled according to manufacturer's specifications.
- 3.5 Make sure that hose connections fit properly and are equipped with a mechanical means of securing the connection between tool/hose/compressor to prevent whipping in case of disconnection or failure (e.g. chains, tie wires, whip checks or equivalent retaining devices).
- 3.6 Safety clips or tool retainers must be in place on pneumatic impact tools to prevent accessories (e.g. chisel on a chipping hammer) or attachments from being ejected.
- 3.7 If an air hose is more than 1/2-inch (12.7 mm) in diameter, a safety excess flow valve must be installed at the source of the air supply to reduce pressure in case of hose failure.
- 3.8 In general, the same precautions should be taken with an air hose that are recommended for electric cords, as the hose is subject to the same kind of damage or accidental striking, and because it also presents tripping hazards. Avoid creating trip hazards caused by hoses laid across walkways, curled underfoot, on ladders.
- 3.9 Airless spray guns that atomize paints and fluids at pressures of 1,000 pounds or more per square inch (6,890 kPa) must be equipped with automatic or visible manual safety devices that will prevent pulling the trigger until the safety device is manually released.

- 3.10 Ensure that the compressed air supplied to the tool is clean and dry. Dust, moisture, and corrosive fumes can damage a tool. An in-line regulator filter and lubricator increases tool life.
- 3.11 Keep tools clean and lubricated, and maintain them according to the manufacturers' instructions.
- 3.12 Use only the attachments that the manufacturer recommends for the tools in use.
- 3.13 Use the proper hose and fittings of the correct diameter and type for the pneumatic or hydraulic application.
 - 3.13.1 The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.
 - 3.13.2 Use hoses specifically designed to resist abrasion, cutting, crushing and failure from continuous flexing.
 - 3.13.3 Choose air supply hoses that have a minimum working pressure rating of 150 pounds per square inch gauge or 150 percent of the maximum pressure produced in the system, whichever is higher.
 - 3.13.4 Check hoses regularly for cuts, bulges and abrasions. Tag and replace, if defective.
- 3.14 Install quick disconnects of a pressure-release type rather than a disengagement type. Attach the male end of the connector to the tool, NOT the hose.
- 3.15 Reduce physical fatigue by supporting heavy tools with a counter-balance wherever possible.
- 3.16 Do not operate the tool at a pressure above the manufacturer's rating.
- 3.17 Turn off the air pressure to the hose, exhaust the airline and disconnect the tool from the air supply when not in use, before servicing or when changing power tools or attachments.
- 3.18 Do not carry a pneumatic tool by its hose.
- 3.19 Do not use compressed air for cleaning purposes unless the pressure is reduced to 30 pounds per square inch (psi) or less. This rule does not apply for concrete form, mill scale, green cutting, and similar cleaning operations. Proper respiratory, hand, eye, and ear protection must be worn.
- 3.20 Compressed air guns shall never be pointed toward anyone.
 - 3.20.1 Employees shall never "dead-end" them against themselves or anyone else.
 - 3.20.2 A chip guard shall be used when compressed air is used for cleaning.
 - 3.20.3 Never use compressed air to blow debris or to clean dirt from clothes or body.

4.0 Personal Protective Equipment

- 4.1 Gloves providing appropriate protection to the task (e.g. impact, puncture, chemical, etc.)
- 4.2 Safety toed boots
- 4.3 Use hearing protection, where required.
- 4.4 Wear safety glasses with side shields at all times and face shield if flying debris may be encountered.

Manual Hand Tools

S3NA-305-ATT15

1.0 General

- 1.1 Review manufacturer's operating manual and *S3NA-305-PR1 Hand & Power Tools* for additional guidelines.
- 1.2 Carry tools using a heavy belt or apron and hang tools at your sides.
- 1.3 Never carry tools in your pockets or hanging behind your back.

2.0 Hammers

- 2.1 Hammers are designed according to the intended purpose. Select a hammer that is comfortable for you and that is the proper size and weight for the job. Misuse can cause the striking face to chip, possibly causing a serious injury.
- 2.2 Choose a hammer with a striking face diameter approximately ½ inch (1.3 centimeters) larger than the face of the tool being struck (e.g., chisels, punches, wedges, etc.).
- 2.3 Strike a hammer blow squarely with the striking face parallel to the surface being struck. Always avoid glancing blows and over and under strikes. (Hammers with beveled faces are less likely to chip or spall).
- 2.4 Look behind and above you before swinging the hammer.
- 2.5 Watch the object you are hitting.
- 2.6 Hold the hammer with your wrist straight and your hand firmly wrapped around the handle.
- 2.7 Do not use handles that are rough, cracked, broken, splintered, sharp-edged or loosely attached to the head. Remove from service and replace the handle if possible.
- 2.8 Do not use any hammer head with dents, cracks, chips, mushrooming, or excessive wear.
- 2.9 Do not use a hammer for any purpose for which it was not designed or intended.
- 2.10 Do not use one hammer to strike another hammer, other hard metal objects, stones or concrete.
- 2.11 Do not redress, grind, weld or reheat-treat a hammer head.
- 2.12 Do not strike with the side or cheek of the hammer.

3.0 Pipe Cutters, Reamers, Taps and Threaders

- 3.1 Replace pipe cutter wheels which are nicked or otherwise damaged.
- 3.2 Use a three- or four-wheeled cutter, if there is not enough space to swing the single wheel pipe cutter completely around the pipe.
- 3.3 Choose a cutting wheel suitable for cutting the type of pipe material required:
 - 3.3.1 Thin wheel for cutting ordinary steel pipe.
 - 3.3.2 Stout wheel for cutting cast iron.
 - 3.3.3 Other wheels for cutting stainless steel, plastic and other materials.
- 3.4 Select the proper hole diameter and correct tap size to tap a hole. The hole should be sized so that the thread cut by the tap will be about 75 percent as deep as the thread on the tap.
- 3.5 Use a proper tap wrench (with a "T" handle) for turning a tap.
- 3.6 Use lubricant or machine cutting fluid with metals other than cast iron.

- 3.7 Do not permit chips to clog flutes (grooves in the tap that allow metal chips to escape from the hole). The chips may prevent the tap from turning – this may result in the tap breaking if you continue to apply pressure.
- 3.8 Do not attempt to thread hardened steel. This can chip or damage the die.
- 3.9 Do not thread any rod or other cylindrical object that is larger in diameter than the major diameter of the die thread.
- 3.10 Do not use a spiral reamer on a rotating pipe. The reamer may snag and cause serious injury.

4.0 Pliers and Wire Cutters

- 4.1 Pliers are made in various shapes and sizes and for many uses. Use the correct pliers or wire cutters for the job.
- 4.2 Choose pliers or wire cutters that have a grip span of 2½ – 3½ inches (6.4 – 8.9 centimeters) to prevent palm or fingers from being pinched when the tools are closed.
- 4.3 Use adjustable pliers that allow for a firm grip of the work piece while maintaining a comfortable handgrip (i.e., hand grasp is not too wide).
- 4.4 Use tools only if they are in good condition.
 - 4.4.1 Make sure that the cutting edges are sharp. Dull and worn-down cutting edges require many times more force for cutting.
 - 4.4.2 Make sure that the toothed jaws are clean and sharp. Greasy or worn-down jaws can result in compromised safety. Such tools also require increased force to hold the work piece which, in turn, increases the risk of muscular fatigue and repetitive strain injuries.
- 4.5 Oil pliers and wire cutters regularly. A drop of oil on the hinge will make the tools easier to use.
- 4.6 Pull on the pliers; do not push away from you when applying pressure. If the tool slips unexpectedly, you may lose your balance or injure your hand.
- 4.7 Cut at right angles. Never rock the cutting tool from side to side or bend wire back and forth against the cutting edges.
- 4.8 Do not cut hardened wire unless the pliers or wire cutters are specifically manufactured for this purpose.
- 4.9 Do not expose pliers or wire cutters to excessive heat.
- 4.10 Do not bend stiff wire with light pliers. Needle-nose pliers can be damaged by using the tips to bend large wire. Use a sturdier tool.
- 4.11 Do not use pliers as a hammer.
- 4.12 Do not hammer on pliers or wire cutters to cut wires or bolts.
- 4.13 Do not extend the length of handles to gain greater leverage. Use a larger pair of pliers for gripping or a bolt cutter for cutting.
- 4.14 Do not use cushion grip handles for jobs requiring tools with electrically insulated handles. Cushion grips are for comfort primarily and do not protect against electric shock.
- 4.15 Do not use pliers on nuts and bolts; use a wrench.

5.0 Screwdrivers

- 5.1 Screwdrivers are made in various shapes and sizes and for many uses. Use the correct screwdriver for the job.
- 5.2 Choose contoured handles that fit the shank tightly, with a flange to keep the hand from slipping off the tool.

- 5.3 Use a slot screwdriver with a blade tip width that is the same as the width of the slotted screw head.
- 5.4 For cross-head screws, use the correct size and type of screwdriver; a Phillips screwdriver may slip out of a screw head designed for use with the slightly flatter-tipped Pozidriv screwdriver.
- 5.5 Use a vise or clamp to hold the stock if the piece is small or moves easily.
- 5.6 Keep the screwdriver handle clean. A greasy handle could cause an injury or damage from unexpected slippage.
- 5.7 If work must be carried out on "live" electrical equipment, use screwdrivers that have insulated handles designed for electrical work and a non-conducting shaft. Remember, most plastic handles are designed for grip and comfort.
- 5.8 Use non-magnetic tools when working near strong magnets (e.g., in some laboratories).
- 5.9 Use a screw-holding screwdriver (with screw-holding clips or magnetic blades) to get screws started in awkward, hard-to-reach areas. Square-tipped screwdrivers (e.g., Robertson) that hold screws with recessed square holes are also useful in such situations.
- 5.10 Use an offset screwdriver in close quarters where a conventional screwdriver cannot be used.
- 5.11 Use a screwdriver that incorporates the following features when continuous work is needed:
 - 5.11.1 Use a pistol grip to provide for a straighter wrist and better leverage.
 - 5.11.2 Use a "Yankee drill" mechanism (spiral ratchet screwdriver or push screwdriver) which rotates the blade when the tool is pushed forward.
 - 5.11.3 Use a ratchet device to drive hard-to-move screws efficiently, or use a powered screwdriver.
- 5.12 File a rounded tip square making sure the edges are straight. A dull or rounded tip can slip out of the slot and cause hand injury or damage to materials.
- 5.13 Store screwdrivers in a rack or partitioned pouch so that the proper screwdriver can be selected quickly.
- 5.14 Do not lean or push on a screwdriver with any more force than necessary to keep contact with the screw. A screw properly piloted and fitted will draw itself into the right position when turned. Keep the shank directly over the screw being driven.
- 5.15 Do not hold the stock in one hand while using the screwdriver with the other as an injury may result if the screwdriver slips out of the slot.
- 5.16 Do not hammer screws that cannot be turned.
- 5.17 Do not grind the screwdriver tip to fit another size screw head.
- 5.18 Do not try to use screwdrivers on screw heads for which they are not designed (e.g., straight blade screwdrivers on Phillips, clutch head, Torx or multi-fluted spline screw heads).
- 5.19 Do not use defective screwdrivers (e.g. rounded or damaged edges or tips; split or broken handles; bent shafts).
- 5.20 Do not use a screwdriver for prying, punching, chiseling, scoring, scraping or stirring paint.
- 5.21 Do not use pliers on the handle of a screwdriver for extra turning power. A wrench should be used only on the square screwdriver shank designed for that purpose.
- 5.22 Do not expose a screwdriver blade to excessive heat. Heat can affect the temper of the metal and weaken the tool.
- 5.23 Do not use a screwdriver to check if an electrical circuit is live. Use a suitable meter or other circuit testing device.
- 5.24 Do not carry screwdrivers in clothing pockets.

6.0 Snips

- 6.1 Wear safety glasses and protective gloves when working with snips. Small pieces of metal may go flying in the air and cut edges of metal are sharp.
- 6.2 Snips are made in various shapes and sizes for various tasks. The handle can be like those on scissors with finger and thumb holes or like plier handles. Models are available for cutting in straight lines and in curves to the left or right.
- 6.3 Select the right size and type of snips for the job; check the manufacturer's specifications about the intended use of the snips (e.g., type of cut - straight, wide curve, tight curve, right or left, and maximum thickness and kind of metal or other material that can be cut).
 - 6.3.1 Universal snips can cut in both straight and wide curves.
 - 6.3.2 Straight snips and duckbill snips (flat blade, "perpendicular" to the handle, with pointed tips) are generally designed to cut in straight lines; some duckbill snips are designed for cutting curved lines.
 - 6.3.3 Hawk's bill snips (with crescent-shaped jaws) are used for cutting tight circles.
 - 6.3.4 Aviation snips have compound leverage that reduces the effort required for cutting.
 - 6.3.5 Offset snips have jaws that are set at an angle from the handle.
- 6.4 Use only snips that are sharp and in good condition.
- 6.5 Use snips for cutting soft metal only. Hard or hardened metal should be cut with tools designed for that purpose.
- 6.6 Use ordinary hand pressure for cutting. If extra force is needed, use a larger tool.
- 6.7 Cut so that the waste is on the right if you are right-handed or on the left if you are left-handed.
- 6.8 Avoid springing the blades. This results from trying to cut metal that is too thick or heavy for the snips you are using.
- 6.9 Keep the nut and the pivot bolt properly adjusted at all times.
- 6.10 Oil the pivot bolt on the snips occasionally.
- 6.11 Do not try to cut sharp curves with straight cut snips.
- 6.12 Do not cut sheet metal thicker than the manufacturer's recommended upper limit (e.g., cuts up to 16-gauge cold, rolled steel or 18-gauge stainless steel). Do not extend the length of handles to gain greater leverage.
- 6.13 Do not hammer or use your foot to exert extra pressure on the cutting edges.
- 6.14 Do not use cushion grip handles for tasks requiring insulated handles. They are for comfort primarily and not for protection against electric shocks.
- 6.15 Do not attempt to re-sharpen snips in a sharpening device designed for scissors, garden tools, or cutlery.

7.0 Wrenches

- 7.1 Use the correct wrench for the job - pipe wrenches for pipes and plumbing fittings, and general-use wrenches for nuts and bolts.
 - 7.1.1 Do not use pipe wrenches on nuts and bolts.
 - 7.1.2 Use a box or socket wrench with a straight handle, rather than an off-set handle, when possible.
 - 7.1.3 Do not use a conventional adjustable wrench for turning a tap – it will cause uneven pressure on the tap that may cause it to break.
 - 7.1.4 Do not use a makeshift wrench.

- 7.2 Inspect pipe wrenches periodically for worn or unsafe parts and replace them:
 - 7.2.1 Wrenches must not be used when jaws are sprung to the point that slippage occurs.
 - 7.2.2 Ensure that the teeth of a pipe wrench are sharp, clean and free of oil and debris.
 - 7.2.3 Do not use worn adjustable wrenches. Inspect the threads, knurl, jaw and pin for wear.
 - 7.2.4 Discard any bent or damaged wrenches (e.g., open-ended wrenches with spread jaws or box wrenches with broken or damaged points).
- 7.3 Select the correct jaw size to avoid slippage.
 - 7.3.1 Ensure that the jaw of an open-ended wrench is in full contact (fully seated, "flat," not tilted) with the nut or bolt before applying pressure.
 - 7.3.2 Face a pipe wrench or adjustable wrench "forward," adjust tightly and turn the wrench so pressure is against the permanent or fixed jaw. Do not pull on a wrench that is loosely adjusted.
 - 7.3.3 Adjust the pipe wrench grip to maintain a gap between the back of the hook jaw and the pipe. This concentrates the pressure at the jaw teeth, producing the maximum gripping force. It also aids the ratcheting action.
 - 7.3.4 Do not insert a shim in a wrench for better fit.
 - 7.3.5 Before applying pressure, ensure that the jaws have a good bite.
 - 7.3.6 Make sure adjustable wrenches do not "slide" open during use.
 - 7.3.7 Do not increase the leverage by adding sleeved additions (e.g., a pipe) to increase tool handle length. Use a larger wrench as necessary.
- 7.4 Ensure that the pipe or fitting is clean to prevent unexpected slippage and possible injury.
- 7.5 Maintain a proper stance with feet firmly placed to maintain balance.
 - 7.5.1 Position the body in a way that will prevent loss of balance and injury if the wrench slips or something (e.g., a bolt) suddenly breaks.
 - 7.5.2 Pull, rather than push on the wrench handle as body balance is more likely to be maintained if the wrench slips.
 - 7.5.3 Pull using a slow, steady pull; do not use fast, jerky movements.
- 7.6 Apply a small amount of pressure to a ratchet wrench initially to ensure that the ratchet wheel (or gear) is engaged with the pawl (a catch fitting in the gear) for the direction you are applying pressure.
- 7.7 Support the head of the ratchet wrench when socket extensions are used.
- 7.8 Stand aside when work is done with wrenches overhead.
- 7.9 Do not use a wrench on moving machinery.
- 7.10 Do not use the wrong tools for the job. For example: Do not use pliers instead of a wrench or a wrench as a hammer. Do not use pipe wrenches for lifting or bending pipes.
- 7.11 Do not strike a wrench (except a "strike face" wrench) with a hammer or similar object to gain more force.
- 7.12 Do not expose a wrench to excessive heat (like from a blow torch) that could affect the temper of the metal and ruin the tool.

8.0 Files/Rasps

- 8.1 Do not use a file as a pry bar, hammer, screwdriver, or chisel.
- 8.2 When using a file or a rasp, grasp the handle in one hand and the toe of the file in the other.
- 8.3 Do not hammer on a file.

9.0 Chisels and Punches

- 9.1 Use the right size and type of chisel (metal or wood) or punch (drift pin, centre, pin) for the job.
- 9.2 Use tools only if they are good condition (i.e., cutting edges are sharp, struck head is not mushroomed or chipped).
 - 9.2.1 Do not use chisels or punches if the cutting edge is dull, mushroomed or chipped, or if the point of a punch is slanted or damaged.
 - 9.2.2 Choose smooth, rectangular handles that have no sharp edges and are attached firmly to the chisel. Replace broken or splintered handles.
 - 9.2.3 Redress striking tools with burred or mushroomed heads.
 - Redress the point or cutting edge to its original shape.
 - Do not use a grinder to redress heat-treated tools. Use a whetstone.
 - Grind to a slightly convex cutting edge.
 - The point angle of the chisel should be 70° for hard metals, 60° for soft.
 - Do not apply too much pressure to the head when grinding a chisel. The heat generated can remove the temper. Immerse the chisel in cold water periodically when grinding.
 - 9.2.4 Replace any chisel or punch that is bent, cracked, shows excessive wear or cannot successfully be redressed.
- 9.3 Check stock thoroughly for knots, staples, nails, screws, or other foreign objects before chiseling or punching.
- 9.4 Hold the chisel, for shearing and chipping, at an angle which permits the bevel of the cutting edge to lie flat against the shearing plane.
- 9.5 Use the appropriate type and size of hammer for the chisel or punch, such as:
 - 9.5.1 A wooden or plastic mallet with a large striking face on chisels.
 - 9.5.2 Heavy-duty or framing chisels made of a solid or molded handle can be struck with a steel hammer.
 - 9.5.3 Ball-peen hammers are generally chosen for use with punches.
 - 9.5.4 Refer to the 'Hammers' section of this document for further guidance.
- 9.6 Chip or cut away from the body. Keep hands and body behind the cutting edge.
- 9.7 Make finishing or paring cuts with hand pressure alone.
- 9.8 Provide hand protection if possible:
 - 9.8.1 Use a sponge rubber shield, punch or chisel holder.
 - 9.8.2 Clamp small work pieces in a vise and chip towards the stationary jaw when working with a chisel.
 - 9.8.3 Do not allow bull point chisels to be hand-held by one employee and struck by another. Use tongs or a chisel holder to guide the chisel so that the holder's hand will not be injured.
- 9.9 Do not use cold chisels for cutting or splitting stone or concrete.
- 9.10 Do not use a drift pin punch (also called an aligning punch) as a pin punch intended for driving, removing, or loosening pins, keys, and rivets.
- 9.11 Do not use a wood chisel on metal.
- 9.12 Do not use a wood chisel as a pry or a wedge.
- 9.13 Place chisels safely within the plastic protective caps to cover cutting edges when not in use.

- 9.14 Store chisels in a “storage roll,” a cloth or plastic bag with slots for each chisel, and keep them in a drawer or tray.

10.0 Hacksaws

- 10.1 Select correct blade for material being cut.
- 10.2 Keep saw blades clean and lightly oiled using light machine oil on the blade to keep it from overheating and breaking.
- 10.3 Secure blade with the teeth pointing forward. Tighten the nut until the blade is under tension.
- 10.4 Keep blade rigid, and frame properly aligned.
- 10.5 Cut using steady strokes, directed away from you.
- 10.6 Use entire length of blade in each cutting stroke.
- 10.7 Cut harder materials more slowly than soft materials.
- 10.8 Clamp thin, flat pieces requiring edge cutting.
- 10.9 Do not apply too much pressure on the blade as the blade may break.
- 10.10 Do not twist when applying pressure.
- 10.11 Do not use when the blade becomes loose in the frame.

11.0 Vises

- 11.1 When clamping a long work piece in a vise, support the far end of the work piece by using an adjustable pipe stand, saw horse or box.
- 11.2 Position the work piece in the vise so that the entire face of the jaw supports the work piece.
- 11.3 Do not use a vise that has worn or broken jaw inserts, or has cracks or fractures in the body of the vise.
- 11.4 Do not slip a pipe over the handle of a vise to gain extra leverage.

12.0 Clamps

- 12.1 Do not use a C-clamp for hoisting materials.
- 12.2 Do not use a C-clamp as a permanent fastening device.

13.0 Pry Bars

- 13.1 Establish balance and stable footing when using a bar for prying.
- 13.2 Pry bars must be appropriate to the task to prevent slipping or tool breakage.

14.0 Jacks

- 14.1 All jacks—including lever and ratchet jacks, screw jacks, and hydraulic jacks—must have a stop indicator, and the stop limit must not be exceeded.
- 14.2 The manufacturer’s load limit must be permanently marked in a prominent place on the jack, and the load limit must not be exceeded.
- 14.3 A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Put a block under the base of the jack when the foundation is not firm, and place a block between the jack cap and load if the cap might slip.
- 14.4 To set up a jack, make certain of the following:

- 14.4.1 The base of the jack rests on a firm, level surface;
 - 14.4.2 The jack is correctly centered;
 - 14.4.3 The jack head bears against a level surface; and
 - 14.4.4 The lift force is applied evenly.
- 14.5 Clear all tools, equipment and any other obstructions from under the load before lowering the jack.
- 14.6 Proper maintenance of jacks is essential for safety. All jacks must be lubricated regularly. In addition, each jack must be inspected according to the following schedule:
- 14.6.1 For jacks used continuously or intermittently at one site—inspected at least once every 6 months;
 - 14.6.2 For jacks sent out of the shop for special work—inspected when sent out and inspected when returned; and
 - 14.6.3 For jacks subjected to abnormal loads or shock—inspected before use and immediately thereafter.

Small Engines

S3NA-305-ATT16

1.0 Objective / Overview

- 1.1 Operate small engine machines (liquid fuel tools), such as push mowers, weed trimmers, pumps and leaf blowers, in a safe manner.
- 1.2 Workers must be trained and competent in the safe operation and maintenance of the tool.

2.0 Potential Hazards

- 2.1 Flying debris
- 2.2 Noise
- 2.3 Moving and sharp parts
- 2.4 Hot surfaces

3.0 Safe Operating Guidelines

- 3.1 Review *S3NA-305-PR1 Hand & Power Tools* and the manufacturer's operating manual for further guidance.
- 3.2 Do not wear loose or baggy clothing around tools with rotating parts.
- 3.3 Never run the engine indoors, in poorly ventilated areas, or in a location where the exhaust could be drawn into a building through an opening.
 - 3.3.1 When an engine must be operated in an enclosed space, effective ventilation and/or proper respirators such as atmosphere-supplying respirators must be utilized to avoid breathing carbon monoxide.
- 3.4 Never store engine with fuel in fuel tank inside a building with potential sources of ignition such as hot water and space heaters, clothes dryers, electric motors, etc.
- 3.5 Ensure the fuel cap is in place. Never start or operate the engine with the fuel fill cap removed.
- 3.6 Refuelling:
 - 3.6.1 Never remove fuel cap or add fuel when engine is running.
 - 3.6.2 Shut down the engine and allow it to cool prior to refueling to prevent accidental ignition of hazardous vapors.
 - 3.6.3 Never pour gasoline on hot surfaces.
 - 3.6.4 Fill in well-ventilated area.
 - 3.6.5 Do not re-fuel around an open flame or while smoking.
- 3.7 Use only properly labelled, American National Standards Institute/Canadian Standards Association-approved red gasoline containers to store and dispense fuel.
- 3.8 The worker must be careful to handle, transport, and store gas or fuel only in approved flammable liquid containers, according to proper procedures for flammable liquids.
- 3.9 Noise hazards associated with gasoline engines must be mitigated by the use of proper hearing protection. Ear plugs, ear muffs or a combination of the two must be used to protect workers from excessive noise levels.
- 3.10 Appropriate fire extinguishers must also be available in the area.

- 3.11 Do not pour fuel from engine or siphon fuel by mouth.
- 3.12 Never leave the engine unattended while it is running.
- 3.13 Never operate the engine with an unguarded engine shaft.
- 3.14 Do not modify the engine or tamper with the factory setting of the engine governor.
- 3.15 Never operate the engine without a muffler guard in place and avoid touching hot areas of the engine.
- 3.16 Keep all flammable materials away from the muffler and the rest of the engine; do not idle or park the engine in dry grass or ground cover.
- 3.17 When working on the equipment, avoid accidental starts by removing the ignition key, turn off all engine switches, disconnect the battery and disconnect the spark plug, keeping it away from metal part.

4.0 Personal Protective Equipment

- 4.1 Always wear safety glasses with shields. Add face shield if potential for flying debris.
- 4.2 Gloves providing the appropriate protection (e.g. impact, abrasion, chemical, etc.).
- 4.3 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts. Long pants and long sleeve shirt.
- 4.4 Safety toe work boots.
- 4.5 Hearing protection (earmuffs or earplugs).

Americas

Electric & Battery Hand Tools

S3NA-305-ATT17

1.0 Objective / Overview

- 1.1 Electric and battery hand tools, also known as power tools, allow the user to perform their task more easily by providing more torque, speed, etc.

2.0 Hazards

- 2.1 Electricity

3.0 Safe Work Practices (General)

- 3.1 Review manufacturer's operating manual and *S3NA-305-PR1 Hand & Power Tools* for additional guidelines.
- 3.2 All electrical tools and equipment must be operated in accordance with the requirements of *S3NA-302-PR1 Electrical Safety*.
- 3.3 Keep all people not involved with the work at a safe distance from the work area.
- 3.4 Inspect power tools prior to each use.
 - 3.4.1 Ensure that the power tool has the correct guard, shield or other attachment that the manufacturer recommends.
 - 3.4.2 Ensure that the tools are properly grounded using a three-prong plug (no loose or faulty prongs), are double insulated (and are labeled as such), or are powered by a low-voltage isolation transformer; this will protect users from an electrical shock.
 - 3.4.3 Check the handle and body casing of the tool for cracks or other damage.
 - 3.4.4 If the tool has auxiliary or double handles, check to see that they installed securely.
 - 3.4.5 Inspect cords for defects: check the plug and power cord for cracking, fraying, and other signs of wear or faults in the cord insulation.
 - 3.4.6 Ensure power tool switches and triggers are fully functional.
 - 3.4.7 If equipped with a trigger-lock, ensure it is disabled.
 - 3.4.8 If a power tool is defective, remove it from service, and tag it clearly "Out of service for repair" or "Do Not Use". Replace damaged equipment immediately – do not use defective tools "temporarily."
DO NOT ATTEMPT FIELD REPAIRS.
- 3.5 Maintain tools with care; keep them sharp and clean for best performance.
- 3.6 Follow instructions in the user's manual for lubricating and changing accessories.
- 3.7 Do not over-reach. Be sure to keep good footing and maintain good balance when operating power tools.
- 3.8 If they are available, choose tools with double handles to permit easier holding and better manipulation of the tool.
- 3.9 Do not brush away sawdust, shavings or turnings while the power tool is running. Never use compressed air for cleaning surfaces or removing sawdust, metal turnings, etc.
- 3.10 Do not operate power tools that are not specified as intrinsically safe in an area containing explosive vapors or gases.
- 3.11 Do not clean tools with flammable or toxic solvents.
- 3.12 Do not surprise or touch anyone who is operating a power tool. Startling an operator could result in injury or

property damage.

- 3.13 Hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released.
 - 3.13.1 Powered hand tools shall not be capable of being locked in the ON position. Trigger locks are not permitted.
 - 3.13.2 All power tools should be ordered without trigger locks; if a tool is found with a trigger lock intact it must be disabled.
- 3.14 Avoid accidental starting. Do not hold fingers on the switch button, and ensure it is in the OFF position while plugging the tool in or while carrying an energized (plugged-in, battery in place) tool.
- 3.15 Do not leave a running tool unattended and ensure the power tool will not re-energize when not in use and when servicing, cleaning, making adjustments, applying flammable solutions or changing accessories:
 - 3.15.1 Ensure it has stopped running completely.
 - 3.15.2 Ensure the trigger or switch is OFF.
 - 3.15.3 Ensure the power tool is disconnected from the power supply (unplugged or battery removed).
- 3.16 Operate power tools within their design limitations.
- 3.17 Store power tools, batteries and electrical cords in a clean, dry area off the ground when not in use.
- 3.18 Do not use power tools in damp or wet locations unless they are approved for that purpose.
- 3.19 Keep work areas well lighted when operating power tools.
- 3.20 Equipment must have proper guards or shields and they must remain in place to protect the operator and others from the following:
 - 3.20.1 Point of operation.
 - 3.20.2 In-running nip points.
 - 3.20.3 Rotating parts.
 - 3.20.4 Flying chips and sparks.
- 3.21 If a guard is removed to clean or repair parts, replace it before testing the equipment and returning the machine to service
- 3.22 If, due to damage or deterioration, the original guard provided on a piece of equipment cannot be put in place, the tool must be removed from service.
- 3.23 Do not modify, remove, or disable any machine guards.
- 3.24 Remove any wrenches and adjusting tools before turning on a tool.
- 3.25 Use clamps, a vice or other devices to hold and support the piece being worked on, when practical to do so. This will allow you to use both hands for better control of the tool and will help prevent injuries if a tool jams or binds in a work piece.

4.0 Battery Powered Tools

- 4.1 Use only the type of battery specified by the tool manufacturer for the battery-powered tool to be used.
- 4.2 Recharge a battery or battery-powered tool only with a charger that specified for the battery.
- 4.3 Store a battery pack safely so that no metal parts, nails, screws, wrenches and so on can come in contact with the battery terminals; this could result in shorting out the battery and possibly cause sparks, fires or burns.

5.0 Safe Work Practice (Electric)

- 5.1 During use, keep power cords clear of tools and the path that the tool will take.
- 5.2 Employees' hands shall not be wet when plugging and unplugging cord and plug connected equipment and extension cords.
- 5.3 Portable electric equipment shall be disconnected when not in use, before servicing, and when changing accessories such as blades, bits, and cutters.
- 5.4 Portable electric equipment and extension cords used in potentially wet locations shall be approved for use in those locations by a nationally recognized testing laboratory, inspection agency, or other organization concerned with product evaluation (e.g., F.M., UL, etc.).
- 5.5 The outlet box for portable extension cords for outdoor use shall be weatherproof and shall be maintained in good condition.
- 5.6 Maintain electrical cords and connections in good working order:
 - 5.6.1 Cords and connection must be American National Standards Institute/Canadian Standards Association approved and bear a standardized certification marking (e.g., CSA, ANSI, UL, CE etc.).
 - 5.6.2 To prevent overheating, use only approved extension cords that have the proper wire size for the length of cord and power requirements of the electric tool to be used.
 - Do not connect or splice extension cords together to make a longer connection.
 - For outdoor work, use outdoor extension cords marked "W-A" or "W."
 - 5.6.3 Eliminate octopus connections: if more than one receptacle plug is needed, use a power bar or power distribution strip that has an integral power cord and a built-in overcurrent protection.
 - 5.6.4 Portable electrical equipment shall not be carried by the cord, nor raised or lowered by the cord.
 - 5.6.5 Electrical cords shall not be removed from a receptacle by pulling on the cord line.
 - 5.6.6 Cords shall not be placed across walkways unless appropriate cord and worker protection is in place to prevent damage to the cord and worker tripping hazards (e.g. cable protectors, cords suspended over walkway, etc.).
 - 5.6.7 Do not walk on or allow vehicles or other moving equipment to pass over unprotected power cords. Cords should be put in conduits or protected by placing planks on each side of them.
 - 5.6.8 A cord should not be pulled or dragged over nails, hooks, or other sharp objects that may cause cuts in the insulation.
 - 5.6.9 Keep cords away from heat, oil, sharp edges and moving parts.
 - 5.6.10 Never use extension cords as permanent wiring as they are for temporary use only. Do not run behind bookshelves, or furniture if the cord cannot be monitored for severe bending or damage.
 - 5.6.11 Inspect cords frequently for such damage such as fraying, kinks, cuts, and cracked or broken outer jackets. Any cord that exhibits damage or feels more than comfortably warm to the touch shall be removed from service, tagged "Do Not Use" and checked by an electrician.
 - 5.6.12 Do not tie power cords in knots. Knots can cause short circuits and shocks. Loop the cords or use a twist lock plug.
- 5.7 Electrical shock associated with power tool use can cause heart failure and burns, as well as injury from falls. Under certain conditions, even a small amount of electric current can result in fibrillation of the heart and death.
 - 5.7.1 Verify that the power source is the same voltage and current as indicated on the nameplate of the tool. Using a higher voltage can cause serious injury to the operator as well as burn out the tool.
 - 5.7.2 All electrical connections for these tools must be suitable for the type of tool and the working

conditions (wet, dusty, flammable vapors).

- 5.7.3 To protect the worker from shock and burns, electric tools must have a three-wire cord with a ground and be plugged into a grounded receptacle, be double insulated, or be powered by a low-voltage isolation transformer.
- 5.7.4 All outdoor receptacles must be protected by means of a ground fault circuit interrupter (GFCI or GFI) available in portable or fixed models. Do not use any electric power tools outdoors in a receptacle that is not properly protected.
- 5.7.5 Three-wire cords contain two current-carrying conductors and a grounding conductor. Any time an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground.
- 5.7.6 The third prong must never be removed from the plug.
- 5.7.7 Double-insulated tools are available that provide protection against electrical shock without third-wire grounding. On double-insulated tools, an internal layer of protective insulation completely isolates the external housing of the tool.
- 5.7.8 Avoid body contact with grounded surfaces like refrigerators, pipes and radiators when using electric powered tools; this will reduce the likelihood of shock if the operator's body is grounded.
- 5.7.9 Report all shocks and/or sparks from electrical tools, no matter how minor. The tool in question should be tagged out and not be used until it has been checked for ground fault.
- 5.8 Only authorized persons are permitted to activate, de-activate or lockout electrical equipment.
- 5.9 Where there is or may be a danger to a worker, from the inadvertent operation of electrical equipment, then that equipment must be locked out and tagged prior to commencing work. Refer to *S3NA-325-PR1 Lockout Tagout*.
 - 5.9.1 Switch off all appropriate devices (MCC, Distribution Panel, Disconnect).
 - Stand to one side when engaging or disengaging an electrical circuit breaker to avoid electrical flash backs Lock and tag Electrical Supply devices in the "OFF" position.
 - 5.9.2 Test to be sure the equipment cannot be operated at the STOP-START switch.
 - 5.9.3 Test to be sure electrical equipment is de-energized.
 - 5.9.4 After completion of task, remove padlocks and destroy tags.

6.0 Personal Protective Equipment (Level D PPE)

- 6.1 Wear proper apparel for the task. Long hair, loose or baggy clothing, ties, or jewellery can become caught in moving parts.
- 6.2 Use gloves with protection appropriate to the task (e.g. impact, abrasion, puncture, etc.).
- 6.3 Safety toed boots.
- 6.4 Use hearing protection as necessary.
- 6.5 Kickback aprons as necessary.
- 6.6 Wear safety glasses with side shields at all times (or safety goggles) and face shield if flying debris may be encountered.

7.0 Belt Sanders

- 7.1 Refer to *S3NA-305-ATT11 Sanders*.

8.0 Drills

- 8.1 Refer to *S3NA-305-ATT8 Power Drill*.

9.0 Planers and Joiners

- 9.1 Use blades of the same weight and set at the same height.
- 9.2 Ensure that the blade-locking screws are tight.
- 9.3 Guard planers and joiners to prevent contact with the blades throughout the full length of the cutting area.
- 9.4 Support the material (stock) in a comfortable position that will allow the job to be done safely and accurately.
- 9.5 Check stock thoroughly for staples, nails, screws, or other foreign objects before using a planer.
- 9.6 Start a cut with the infeed table (front shoe) resting firmly on the stock and with the cutter head slightly behind the edge of the stock.
- 9.7 Use two hands to operate a planer - one hand on the trigger switch and the other on a front handle.
- 9.8 Do not put fingers or any object in a deflector to clean out chips while a planer is running.
- 9.9 Disconnect the power supply when stopping to dump out chips.
- 9.10 Do not set a planer down until blades have stopped turning.
- 9.11 Keep all cords clear of cutting area.

10.0 Routers

- 10.1 Ensure that the bit is securely mounted in the chuck and the base is tight.
- 10.2 Put the base of the router on the work, template or guide. Make sure that the bit can rotate freely before switching on the motor.
- 10.3 Secure stock. Never hold or have another individual hold the material. Sudden torque or kickback from the router can cause damage and injury.
- 10.4 Before using a router, check stock thoroughly for staples, nails, screws or other foreign objects.
- 10.5 Keep all cords clear of cutting area.
- 10.6 Always hold both hands on router handles, until a motor has stopped. Do not set the router down until the exposed router bit has stopped turning.
- 10.7 When inside routing, start the motor with the bit above the stock. When the router reaches full power, lower the bit to two times the required depth.
- 10.8 When routing outside edges, guide the router counter clockwise around the work.
- 10.9 When routing bevels, moldings and other edge work, make sure the router bit is in contact with the stock to the left of a starting point and is pointed in the correct cutting direction.
- 10.10 Feed the router bit into the material at a firm, controlled speed.
- 10.11 Softwood may enable fast router cutting speed. With hardwood, knotty and twisted wood, or with larger bits, cutting may be very slow.
- 10.12 The sound of the motor can indicate safe cutting speeds. When the router is fed into the material too slowly, the motor makes a high-pitched whine. When the router is pushed too hard, the motor makes a low growling noise.
- 10.13 When the type of wood or size of the bit requires going slow, make two or more passes to prevent the router from burning out or kicking back.
- 10.14 To decide the depth of cut and how many passes to make, test the router on scrap lumber similar to the work.

11.0 Circular Saws

- 11.1 Refer to *S3NA-305-ATT2 Circular Saw*.

12.0 Other Saws

- 12.1 Use lubricants when cutting metals.
- 12.2 Keep all cords clear of cutting area.
- 12.3 Cut green or wet material slowly and with caution. Check all material being cut for nails, hard knots, etc.
- 12.4 Make sure guards are installed and are working properly.
- 12.4.1 Table saws must be fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.
- Exposed parts of the saw blade under the table must be properly guarded.
 - All swing cutoff and radial saws that are drawn across a table with limit stops to prevent the saw from traveling beyond the edge of the table
- 12.4.2 Ensure band saw blades are fully enclosed except at the point of operation.
- 12.4.3 Ensure swing cut-off saws have a guard completely covering the upper half of the saw.
- 12.5 Remember sabre saws cut on the upstroke.
- 12.6 Position the saw beside the material before cutting and avoid entering the cut with a moving blade.
- 12.7 Secure and support stock as close as possible to the cutting line to avoid vibration.
- 12.7.1 Hold the material being cut firmly against a back guide or fence and cut with a single, steady pass.
- 12.7.2 Use a push stick or guide when cutting operation requires the hands of the operator to come close to the blade.
- 12.7.3 When cutting long stock, provide extension tables and a helper to assist the operator.
- 12.7.4 Keep the base or shoe of the saw in firm contact with the stock being cut.
- 12.7.5 Automatic feed devices should be used whenever feasible.
- 12.8 Select the correct blade for the material being cut and allow it to cut steadily. Do not force it. Clean and sharp blades operate best.
- 12.9 Set the blade to go no further than 1/8 to 1/4 inch deeper than the material being cut.
- 12.10 Do not start cutting until the saw reaches its full power.
- 12.11 Do not force a saw along or around a curve. Allow the machine to turn with ease.
- 12.12 Do not insert a blade into or withdraw a blade from a cut or lead hole while the blade is moving.
- 12.13 Do not put down a saw until the motor has stopped.
- 12.14 Do not reach under or around the stock being cut.
- 12.15 Maintain control of the saw always. Avoid cutting above shoulder height.
- 12.16 External Cuts
- 12.16.1 Make sure that the blade is not in contact with the material or the saw will stall when the motor starts.
- 12.16.2 Hold the saw firmly down against the material and switch the saw on.
- 12.16.3 Feed the blade slowly into the stock, maintaining an even forward pressure.

12.17 Internal Cuts

12.17.1 Drill a lead hole slightly larger than the saw blade. With the saw switched off, insert the blade in the hole until the shoe rests firmly on the stock.

12.17.2 Do not let the blade touch the stock until the saw has been switched on.

Highway & Road Work

S3AM-306-PR1

1.0 Purpose and Scope

- 1.1 To address potential hazards that may occur during highway construction or during work within the right of way of a public or private roadway.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Competent Persons** – are those who are knowledgeable about the fundamental principles of temporary traffic control and the work activities to be performed, and who have the authority to propose and implement corrective measures to eliminate hazardous situations associated with temporary traffic control.
- 2.2 **Personal Protective Equipment (PPE)** – Safety clothing and equipment worn by workers in traffic areas to provide protection and heightened visibility from physical hazards including moving vehicles and construction equipment.
- 2.3 **Traffic areas** – Any work area where workers are located within 20 feet (6.1 metres) of moving traffic, existing or anticipated.
- 2.4 **Traffic Protection Plan** – A detailed plan for the protection of workers in a work zone. The plan shall contain a written description of the traffic hazards to which workers may be exposed and measures used to protect them meeting local legislation. A Traffic Control Plan shall be included as applicable.
- 2.5 **Traffic Control Plan** – A detailed plan for the control of traffic during construction, maintenance, or utility operations on a highway/road, taking into account the organized, systematic, safe conduct of the project, including, as applicable, detours, staging sequences, work vehicle access and egress from work sites, temporary barriers, removal of old pavement markings and selection and planned implementation of appropriate typical layouts for traffic control. Plan shall be written to meet local legislation.
- 2.6 **WOF** – Workers on foot.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-208-PR1 Personal Protective Equipment
- 3.3 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager or Supervisor

- Verify development and administration of the procedures, communication methods, and the measures and configuration of the temporary traffic control zone in accordance with specifications for workers, motorists, and pedestrians, and the protection of AECOM employees.
- Confirm the SH&E Plan and Traffic Protection Plan are developed and communicated to all involved and affected employees.
- Confirm compliance with the SH&E Plan, Traffic Protection Plan, and this procedure.
- Confirm employees assigned to work in traffic areas are trained in the use of traffic control

systems, communication systems, and Personal Protective Equipment (PPE). Assist with any inspections or investigations as appropriate.

- Identify the Competent Person for traffic control or on the project.

4.1.2 **Flag Person**

- Comply with the applicable SH&E Plan, Traffic Protection Plan (including Traffic Control Plan), and communication requirements.
- Use appropriate PPE.
- Maintain training and competency in traffic control and flagging procedures.
- Converse with motorists only to provide clear instructions.
- Maintain alertness at their points of duty until relieved.

4.1.3 **SH&E Representative**

- Assist the Manager/Supervisor with implementation of SH&E Plan, internal Traffic Protection Plan, Traffic Control Plans, and determined communication methods within a highway/road worksite.
- Coordinate traffic safety on the specified project.
- Have training in the requirements of the governing transportation authority and the applicable Occupational Health and Safety legislation.
- Be involved in conducting hazard assessments, developing the mitigating strategies and reviewing their implementation for any project where traffic is identified as a hazard to AECOM staff.
- Assist with any inspections or investigations as appropriate.

4.2 **Training**

- 4.2.1 Employees shall be appropriately trained to the potential exposures to highway and road hazards and the applicable control measures. Refer to the *S3AM-003-PR1 SH&E Training*.
- 4.2.2 All staff shall receive on-site orientation to the hazards and controls, including as applicable, Traffic Protection Plan, Traffic Control Plan, and communication requirements
- 4.2.3 Only staff with appropriate flag person (traffic control) training shall act as a flag person.
- 4.2.4 Flag persons shall be instructed on the specific project Traffic Protection Plan and Traffic Control Plan.
- 4.2.5 Flag persons shall be trained / certified in signaling methods required by the competent person.
- 4.2.6 WOF, equipment operators, and drivers in internal work zones shall be trained to their respective tasks and know the routes that construction vehicles shall use.
- 4.2.7 Equipment operators and signal persons shall know the hand signals to be used, and communication methods and requirements applicable to the worksite.
- 4.2.8 Operators and WOF shall know the visibility limits and the "blind spots" for each vehicle on site.
- 4.2.9 Workers should be made aware of the ways in which hazards associated with shift work and night work may affect their performance.

4.3 **Planning**

- 4.3.1 The SH&E Plan, Traffic Protection Plan and Task Hazards Assessment shall be completed and communicated to all involved and affected workers. In addition to the traffic hazards identified in this procedure, the hazards associated with the highway or road work tasks shall be addressed. These may include, but are not limited to:

- Potential health hazards from asphalt fumes, concrete and rock dust.
 - Lead paint on old bridge work and overpasses.
 - High noise levels.
 - Heat or cold stress.
 - Work over water (bridges, causeways)
 - Work at elevation (overpasses and bridges).
 - Tunneling and blasting.
- 4.3.2 Applicable procedures shall be consulted and appropriate control measures established. Additional specific plans may be necessary for specialized work.
- 4.3.3 PPE selection shall be based on the THA. Refer to the *S3AM-208-PR1 Personal Protective Equipment*.
- 4.4 Traffic accommodation equipment, as required by the Traffic Protection Plan
- 4.4.1 The *traffic* accommodation equipment may entail:
- A rooftop beacon light for the vehicle,
 - Pylons, Glo-posts, flags, barricades and/or flagging tape, warning lights, flashing light boards
 - Advance signage
 - Flagging equipment, as required:
 - Daytime:
 - Flag person's "Stop and Slow" paddle.
 - PPE including high-visibility clothing meeting local legislation.
 - Drinking water.
 - Bug repellent and/or sun screen as conditions warrant.
 - Optional radio communication (if required).
 - Night time (additional requirements):
 - A retro-reflective "Stop and Slow" paddle.
 - A flashlight fitted with a red signaling baton.
 - Flashing yellow beacons set up in advance of the flag person.
 - Additional night time PPE as per jurisdictional requirements.
- 4.5 Traffic Protection Plan
- 4.5.1 Each Manager shall prepare a project Traffic Protection Plan addressing traffic controls and worker protection appropriate for the team's exposures. PPE requirements for all types of workers on the road project shall be specified including surveyors, environmental, QA, inspectors and engineers. The Traffic Protection Plan may be a stand-alone document, or contained within the safety plan if allowed by legislation. Plans shall address the following if applicable:
- Closure zones within the project boundaries
 - Work zone protections: various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck mounted attenuators.
 - Guide vehicles.
 - Communication methods and systems.

- Night operations work within traffic controls.
 - PPE.
 - Sanitation.
 - Traffic Control Plans and permits.
 - Training.
 - Worker and heavy mobile equipment interface.
- 4.5.2 A Traffic Control Plan shall be completed for the movement of vehicles in areas where workers are conducting other tasks.
- 4.5.3 Drivers, WOF and pedestrians shall be able to see and understand the routes they are to follow.
- 4.5.4 Where there are several projects, coordinated vehicle routes and communication between contractors shall reduce vehicular struck-by incidents.
- 4.5.5 Hazard identification and plan development shall be performed in accordance with this procedure. The plans shall include the identification of the responsibility for personnel and implementation of the safety program under highway construction activities.
- 4.5.6 Other requirements for supporting activities such as excavations, heavy equipment usage, personal protective equipment, etc. shall be applicable and addressed in accordance with other procedures.
- A Traffic Protection Plan shall be an integral part of the SH&E Plan whenever staff shall be exposed to the hazards of vehicular traffic during project work (this may include surveys, wetland delineation, drilling and soils inspections, bridge or overpass inspections, inspection of roadway construction projects).
 - Requirements of jurisdictional departments of transportation have varying and specific requirements related to safety and traffic plans. Lighting, signage, information boards and PPE shall comply with the requirements of transportation entity applicable to the project.
 - Work duration, road width, and traffic volume are some of the key considerations to be contemplated when designing a Traffic Protection Plan. The Traffic Protection Plan shall address the specific vehicular hazards and describe the measures that shall be implemented to protect employees.
 - Traffic Protection Plan and Traffic Control Plan shall be developed in consultation with a qualified supervisor or manager experienced in traffic control. In addition, a supervisor shall be designated to oversee the implementation of the protection plan until work is completed.
 - Occupational Health and Safety regulations and associated standards or guidebooks provide instruction on the use of traffic control devices in temporary construction, maintenance, and utility work zones for worker and motorist safety and to minimize the disruption of traffic flow.
 - Schedule work to avoid periods of heavy traffic.
 - Alert traffic of work ahead, by placing signs or cones well ahead of the work area.
 - If the work area is being managed under a Traffic Control Plan or Traffic Protection Plan, obtain copies of these plans before commencing work.
 - Traffic accommodation that is adequate in good weather conditions and daylight may not be adequate under adverse weather conditions and/or hours of darkness. Reassess the accommodation based on conditions.
 - Traffic accommodation shall be planned to provide safe conditions for the protection and safe passage of motorists, pedestrians, and employees at all work sites. It shall include all areas located within the traveled portion of a roadway including shoulders, ditches, and boulevards.

4.6 Restrictions

- 4.6.1 Applicable legislated requirements governing all aspects of traffic safety, including directing traffic, signage, PPE, traffic control devices in temporary construction, maintenance and utility work zones, shall be reviewed in preparation for the site-specific traffic control, protection or accommodation plan.
- 4.6.2 No personnel shall be allowed onto the site without first reviewing the project-specific Traffic Control Plan or Traffic Protection Plan.
- 4.6.3 No Roadwork/Highway work shall be performed without appropriately addressing the traffic hazards present at the site in a Traffic Control Plan or Traffic Protection Plan.
- 4.7 Short-Term Traffic Protection
 - 4.7.1 Always wear the appropriate PPE to maintain worker visibility to vehicular traffic. Wear a tear-away fluorescent reflective vest (and retro-reflective stripes on the arms and legs for night work or during periods of limited visibility) at all times. Refer to *S3AM-208-PR1 Personal Protective Equipment*.
 - 4.7.2 Set out signage to signify workers are performing work on the side of the road.
 - 4.7.3 Pull vehicles off as far to the right of the travelled portion of the road as possible. Confirm the ground is stable where the vehicle is parked; note that parking at the top of earthen ditches should be avoided. Confirm that the shoulder of the highway or street where parking the vehicle is wide enough to allow for safe access to and egress from the vehicle.
 - 4.7.4 Always park a vehicle at least 100 feet (30 meters) from the flag person station. The vehicle should be positioned between the flag person and the work crew. Position vehicles to protect workers from traffic. See information related to Attenuator Vehicles in this procedure.
 - 4.7.5 Activate the four-way flashers and rotating beacon for the vehicle prior to exiting the vehicle.
 - 4.7.6 Plan an escape route prior to exiting the vehicle.
 - 4.7.7 Load and unload materials or equipment from the passenger side of the vehicle.
 - 4.7.8 Always use the buddy system in heavy traffic areas. Employees shall avoid turning their back to oncoming traffic.
 - 4.7.9 Be aware of mobile equipment that may be operating in the work area.
 - 4.7.10 Do not enter onto the travelled portion of the road except to cross the road. Road crossings should be made at a 90 degree angle to the direction of the road.
- 4.8 Long-Term Traffic Protection
 - 4.8.1 Traffic accommodation shall be provided BEFORE the work starts and shall be maintained until the work is completed.
 - 4.8.2 Generally, for long-term duration work activities that are performed at construction projects, the constructor of the project is required to develop a Traffic Protection Plan.
 - 4.8.3 If AECOM has assumed the role of constructor for the project, the Traffic Protection Plan shall be developed and implemented prior to the commencement of work activities at the project.
 - 4.8.4 If AECOM is not the constructor for the project, the Traffic Protection Plan for the project shall be developed by our client or a constructor designated by the client.
 - 4.8.5 The Traffic Protection Plan should be reviewed with AECOM employees during orientation to the project.
- 4.9 Signage
 - 4.9.1 Standard highway signs for information, speed limits, and work zones shall assist drivers in identifying designated traffic paths or conditions ahead.
 - 4.9.2 Provide appropriate instructional signage such as: EVACUATION ROUTE; DO NOT ENTER; REDUCED SPEED AHEAD; ROAD CLOSED; WORKERS AHEAD; and NO OUTLET.

- 4.9.3 Using standard highway signs for internal construction worksite traffic control shall assist workers in recognizing the route they are to use at the construction site.
- 4.9.4 Traffic Signs
 - Signage shall be of acceptable standards, in good condition, clean, legible, suited to the purpose, and meeting local legislation requirements.
 - Signage shall be secured or weighted.
 - Routinely inspect signage for placement, cleanliness, and physical damage.
 - Cover road traffic control signage when no activity is present.
- 4.10 Traffic Control Devices
 - 4.10.1 Standard traffic control devices, signals, and message boards shall instruct drivers to follow a path away from where work is being done.
 - 4.10.2 The competent person shall determine the approved traffic control devices such as cones, barrels, barricades, and delineator posts that shall be used as part of the Traffic Control Plan.
- 4.11 Work Zone Protections
 - 4.11.1 Various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck-mounted attenuators shall be used to limit motorist intrusions into the construction work zone, as appropriate.
 - 4.11.2 All AECOM staff shall be made aware of controls established by the AECOM and the constructor.
 - 4.11.3 AECOM staff shall wear the required safety apparel at all times.
 - 4.11.4 In the absence of a constructor, when AECOM is the constructor, or when AECOM staff are in the field alone—e.g., investigations, surveys—all appropriate Department of Transportation traffic control standards and devices shall be observed and placed in position.
 - 4.11.5 The work zone shall be made safe by its separation from traffic.
- 4.12 Flagging
 - 4.12.1 Flag persons and others providing temporary traffic control shall wear high visibility retro-reflective clothing in compliance with local legislation.
 - 4.12.2 Flag persons shall be provided with sufficient breaks, and shall not be permitted to work alone for extended periods as per local legislation.
 - 4.12.3 Flag persons shall stand in a safe position, be clearly visible, have an unobstructed view of approaching traffic, and be positioned a suitable distance away or from the work area (a distance permitting vehicles to slow down or stop before reaching the work area) unless circumstances or space requirements, such as working at or near an intersection, dictate otherwise.
 - 4.12.4 Drivers should be warned in advance with signs that there shall be a flag person ahead.
 - 4.12.5 Flag person should use STOP/SLOW signs or paddles. The STOP sign should be octagonal with a red background and white letters and border. The SLOW sign should be octagonal with an orange background and black letters and a border.
 - 4.12.6 "Flag Person Ahead" signs shall be posted in advance of each flag person's station. Such signs shall be removed promptly when the flagging operation terminates.
- 4.13 Lighting
 - 4.13.1 Flag person stations should be illuminated. Lighting for workers on foot and equipment operators is to be at least 5 foot candles (54 Lux) or greater.
 - 4.13.2 Where available lighting is not sufficient, flares or chemical lighting should be used.
 - 4.13.3 Glare affecting workers and motorists should be controlled or eliminated.

4.14 Driving

- 4.14.1 Seatbelts and rollover protection shall be used on equipment and vehicles as stated by the manufacturer.
- 4.14.2 When pulling off to the side of the road, AECOM personnel shall park their vehicles at minimum of 20 feet (6 meters) or the width of two traffic lanes from moving traffic.
- 4.14.3 Vehicles and equipment operated in work zones shall be equipped with back up alarms and/or object detection devices to prevent back-over injuries and equipment damage. Spotters should be used to direct equipment and vehicles backing up on work sites.

4.15 Night Operations and Work within Traffic Controls

- 4.15.1 Night work on roadways should not be done unless absolutely necessary and unless the work area is adequately lit.
- 4.15.2 Operations with night activities shall have a written plan that addresses the safety issues of working at night. The plan shall address, but is not limited to:
 - Reflectivity
 - All equipment used in the work zone shall have reflective material placed to increase the visibility of the equipment.
 - All reflective surfaces shall be cleaned as required so that the reflectivity of the material is not degraded. Any areas of reflective surface that is damaged or obscured shall be replaced.
 - Personnel working at night shall have reflective tape on their hardhats and shall wear retro-reflective vests and each limb that meet the legislative requirements. Refer to *S3AM-208-PR Personal Protective Equipment*.
 - Additional measures such as white disposable coveralls, reflective bands, flashlights with red cones and personal battery-operated strobe lights may be used when practical.
 - Illumination
 - Whenever feasible and practical, light plants shall be used to illuminate the work area. Balloon or diffuse lighting portable light towers should be used along highways and where possible to provide glare free illumination.
 - On mobile operations, additional lighting on equipment may be used to illuminate the work area.
 - All equipment shall have working lights and at a minimum, have working strobe or warning beacon lights.
 - All flag persons shall be placed in illuminated areas only.
 - All lighting is to be checked after setup to confirm that it is not interfering with approaching traffic, other equipment in the work zone, and meets the legislative requirements.
 - Task Hazard Analysis and Communication
 - Prior to the start of any night operation, a detailed task hazard assessment (THA) shall be made addressing the possible hazards of night work. Refer to the *S3AM-209-PR1 Risk Assessment & Management*.
 - The THA shall be reviewed with the crews and updated as needed. At the start of each shift, a daily safety reminder shall be used to reaffirm the provisions of the night work requirements as found in the THA and this procedure.
 - The task THA should also provide for:
 - The selection of a competent person responsible for maintaining surveillance on the

work area to alert other workers of vehicles encroaching on the work zone.

- A method to signal workers when vehicles encroach on the work zone.
- A system to account for workers at all times, which may include a buddy system.
- Emergency communication or warning signals used by a worker such as a radio, signal horn, or whistle, which shall be used to call for help.

4.16 Attenuator Vehicles

4.16.1 It is good construction practice to place an attenuator truck or pick-up truck (minimum) an appropriate distance and immediately in advance of workers in a work zone to protect workers from vehicle intrusions and to warn approaching drivers that the shoulder or travel lane is occupied by work activities.

4.16.2 The vehicle of choice should be placed an appropriate distance from the work activities to provide the best protection for workers based on potential speed of traffic.

4.16.3 The tires should be placed so that should the vehicle be struck, it shall turn away from workers.

4.17 Closures within a Closure

4.17.1 On occasion, satellite operations may be performed under full freeway traffic closures. For this type of work, special precautions referred to as a "closure within a closure" is to be implemented in accordance with the following:

- Posted speed limits within closures should be set at 15 miles (24 kilometers) per hour.
- Signs are to be installed approximately 250 feet (76 meters) in advance of and behind the work zone to alert drivers who may approach from either direction of the upcoming work zone.
- The work area is to be completely delineated with Type 1 barricades (candlesticks).
- Any vehicle used for AECOM field work shall be equipped with a functioning four way flashers and rotating beacon placed on the roof of the vehicle.

5.0 Records

5.1 Traffic Protection Plans, Traffic Control Plans and completed Equipment Checklists shall be maintained in project files.

6.0 Attachments

6.1 [S3AM-306-FM1 Equipment Checklist](#)

Americas

Equipment Checklist

S3NA-306-FM1

Name of Contractor (or N/A): _____ Project Name: _____

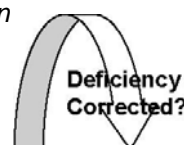
Location: _____ Project #: _____

Date: _____ Time: _____ Weather: _____

Person Conducting Inspection _____ Title: _____

*Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO**, this deficiency should be corrected as soon as possible.*

	YES	NO	OK	N/A
Are accident prevention signs, tags clearly visible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are danger signs used where immediate hazards exist?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are caution signs used to warn against potential hazards or to caution against unsafe practices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are exit signs posted at all exit locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are proper visual warning signs posted prior to (in advance of) the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers provided with signs, signals, and barricades to provide the necessary protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers using red lights when signaling during periods of darkness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers wearing highly visible warning garments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the flaggers trained in proper flagging procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are warning garments worn at night reflectorized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are highly visible flags used by the flaggers at least 18 inches (45 centimeters) square?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are barricades used to totally obstruct the passage of people and vehicles to protect the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



COMMENTS:

Heavy Equipment

S3AM-309-PR1

1.0 Purpose and Scope

- 1.1 Outline the safe working requirements for working with and near heavy equipment and heavy equipment operation.
- 1.2 Military related vehicles and equipment (e.g. tanks) are not covered under this standard.
- 1.3 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Heavy equipment** –All excavating equipment (e.g. scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, graders, agricultural and industrial tractors, etc.), cranes, lift trucks, drills, etc. This may include off-highway trucks (e.g. dump truck, heavy haul truck, etc.). For requirements related to crew trucks refer to *S3AM-005-PR1 Driving*.
- 2.2 **Operator** – Any person who operates the controls while the heavy equipment is in motion or the engine is running.
- 2.3 **Ground personnel/workers** – Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

3.0 References

- 3.1 S3AM-005-PR1 Driving
- 3.2 S3AM-202-PR1 Competent Person Designation
- 3.3 S3AM-213-PR1 Subcontractor Management
- 3.4 S3AM-303-PR1 Excavation
- 3.5 S3AM-322-PR1 Overhead Lines
- 3.6 S3AM-325-PR1 Lockout Tagout
- 3.7 S3AM-331-PR1 Underground Utilities & Subsurface Installation Clearance

4.0 Procedure

- 4.1 Roles and Responsibilities
 - 4.1.1 **Managers / Supervisors**
 - Responsible for confirming all equipment is in good working order and all equipment operators are verified as qualified on the piece of machinery they are assigned.
 - As applicable, review as-built drawings.
 - Maintain operation manuals at the site for each piece of equipment that is present on the site and in use.
 - Maintain a list of operators for the project, and the specific equipment that they are authorized to operate.
 - Prohibit equipment from being operated by any personnel who have not been specifically authorized to operate it.

- Confirm an equipment maintenance inventory is maintained, schedules adhered to and appropriate inspections of equipment are conducted.
- Confirm subcontractors are properly pre-qualified in accordance with *S3AM-213-PR1 Subcontractor Management*.
- Require that subcontractor employees follow established safety procedures in operation, inspection, and maintenance of vehicles and equipment.
- Inform AECOM and subcontractor machinery operators about applicable local regulations restricting the consecutive minutes of engine idling time allowed.
- Confirm subcontractor machinery and mechanized equipment is approved for use in accordance with the requirements of *S3AM-309-FM1 Approval of Machinery & Mechanized Equipment*.
- Confirm that all rented equipment bears any required current certification marks and arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.
- Confirm that AECOM and subcontractor machinery and mechanized equipment is certified, as applicable, in accordance with manufacturer specifications and/or regulatory requirements.
- Visually observe the subcontractors' vehicles and equipment, for any unsafe conditions or practices. Equipment or operation not in compliance with applicable safety standards is prohibited.

4.1.2 **Employees / Ground Personnel**

- Confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.
- Ground personnel when working in the vicinity of heavy equipment shall have received training, and comply with the applicable rules of engagement.

4.1.3 **Operators (of heavy equipment)**

- Operate the equipment safely, maintain full control of the equipment, and comply with manufacturer's operation manual and the laws governing the operation of the equipment.
- Inspect equipment and immediately report defects and conditions affecting the safe operation of the equipment to the appropriate Supervisor.
- Trainees may operate equipment in accordance with jurisdictional requirements and under the direct supervision of a trainer.

4.2 **Communication**

- 4.2.1 Communication between site Managers / Supervisors, heavy equipment Operators, and site Employees / Ground Personnel is a key method of preventing serious injury or death during heavy equipment operations.
- 4.2.2 Managers shall confirm the Industrial site or project specific SH&E Plan is developed and communicated to all affected and involved employees. Refer to *S3AM-209-PR1 Risk Assessment & Management*.
- 4.2.3 Task Hazard Assessments and Daily Tailgate meetings shall be conducted in accordance with *S3AM-209-PR1 Risk Assessment & Management*.
- 4.2.4 Concerning worksites in which other employers control concurrent operations and SH&E issues related to the worksite, the manager shall coordinate with those conducting concurrent operations to confirm appropriate control measures are in place to protect employees from the hazards associated with activities to be performed.

- Coordination shall occur prior to work commencing, periodically thereafter, and as necessary given changes in scope and/or working conditions.
- Affected employees (including managers and supervisors) shall seek to participate in all site SH&E meetings related to concurrent operations.

4.2.5 The following points outline the communication requirements during heavy equipment operations:

- Site Supervisors/t Managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
- Site Supervisors/ Managers shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating on site, the Site Supervisor/ Manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- Ground Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.
- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (e.g., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a signal person shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.3 Ground Personnel

4.3.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.3.2 The following points outline the clearance requirements during heavy equipment operations:

- Ground Personnel shall always yield to heavy equipment.
- Ground Personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A task hazard assessment that identifies any special precautions shall be completed and communicated to all AECOM personnel associated with or affected by the activity.
- Site Supervisors/ Managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas.
 - Designated areas shall include work zone boundaries and travel routes for heavy equipment.
 - Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
 - Work zone boundaries shall consider line of fire hazards related to the equipment and associated activities. Refer also to *S3AM-309-ATT2 Operator Line of Sight*.
 - If working near heavy equipment, Ground Personnel shall stay clear of loads to be lifted or suspended loads, and out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
 - During winch use, all swampers or other personnel will remain outside the “whip area” of the winch line or tow cable.

- At a minimum, employees shall maintain a distance of at least two pile lengths from where piles are being cut and dropped, other than in situations where cut piles are being guided to the ground utilizing mechanical means (e.g., pile driver and shackle) to control the direction and speed of fall of the cut pile.
 - When feasible, Site Supervisors/ Managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
 - Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
 - Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
 - Ground Personnel shall never stand between two pieces of operating heavy equipment or other objects (e.g., steel support beams, trees, buildings, etc.).
 - Ground Personnel shall never stand directly below heavy equipment located on higher ground unless it can be verified ground stability is not a factor and grade of slope is such that it would not contribute to equipment tip-over.
 - Ground Personnel may only enter the swing area, work area or path of travel of any operating equipment when:
 - They have attracted the operator's attention and established eye contact, and
 - The operator has idled the equipment down, placed it in neutral, grounded engaging tools, set brakes and communicated entry is permitted.
 - Employees shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
 - Employees shall not talk, text, or otherwise use a cell phone while standing or walking on a roadway or other heavy equipment path.
- 4.3.3 At a minimum, all Ground Personnel and Operators outside of heavy equipment shall wear the following:
- High visibility safety vest (fluorescent background material and retro-reflective striping) meeting jurisdictional requirements that is visible from all angles.
 - Background material: should be fluorescent yellow-green, fluorescent orange-red or fluorescent red.
 - Combined-performance retro-reflective material (e.g. the stripes): should be fluorescent yellow-green, fluorescent orange-red or fluorescent red - and shall be in contrast (that is, have a distinct color difference) to the background material.
 - Hazards may require high visibility garments that cover torso, legs and arms.
 - Confirm that vest is not faded or covered with outer garments, dirt, etc.
 - American National Standards Institute/Canadian Standards Association- (ANSI/CSA-) approved hard hat
 - ANSI/CSA-approved safety glasses with side shields
 - At a minimum, CSA or ASTM approved, high-cut (min. 6"), puncture, impact and compression resistant footwear.
 - ANSI/CSA-approved hearing protection as needed
 - Appropriate work clothes (e.g., full-length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.4 Prior to work commencing

- 4.4.1 All heavy equipment will be inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.
- Roll-over protection systems (ROPS) and appropriate overhead protection (Fall Object Protection FOP) shall be in place given the specific equipment requirements. Utilize equipment with enclosed cabs where feasible or accessible.
 - Where use of equipment with enclosed cabs is not feasible or said equipment is not accessible, operators shall use any additional personal protective equipment determined as necessary (e.g. goggles, additional hearing protection, etc.).
 - Equipment operated in hazardous atmosphere environments shall be equipped with the proper safety equipment (e.g., spark arrestors, positive air shut off, etc.).
 - Operation of equipment that has or had cab glass (per the manufacturer's specifications) that is cracked/broken (obstructing the operator's view) or missing is prohibited.
 - A locking device shall be provided that will prevent the accidental separation of towed and towing vehicles on every fifth-wheel mechanism and two-bar arrangement.
 - Trip handles for tailgates of dump trucks and heavy equipment shall be arranged so that when dumping, the operator will be in the clear.
 - The Operator will report defects and conditions affecting the safe operation of the equipment to the Site Supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.
 - Exposed moving parts on heavy equipment (belts, gears, shafts, pulleys, sprockets, spindles, drums, fan belts, flywheels, chains, or other reciprocating, rotating or moving parts) which are a hazard to the operator or to other workers will be guarded.
 - If a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.
- 4.4.2 An approved 4A40BC fire extinguisher shall be present on all heavy equipment. An approved 4A40BC fire extinguisher of appropriate rating shall be present and readily accessible on all heavy equipment.
- Fire extinguishers shall be inspected by the operator prior to heavy equipment operation each shift. Monthly and annual inspections shall be documented.
- 4.4.3 All Operators shall inspect the area adjacent to the machine prior to starting.
- Evaluate ground conditions, concurrent operations and obstructions to identify approved routes of travel and work areas.
 - As applicable, check that there is sufficient swing room and that the outriggers are adequately supported on solid and stable ground
- 4.4.4 Managers / Supervisors shall inform the operators of the equipment that AECOM employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, heavy equipment has the 'right of way'.
- 4.4.5 Where the Operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.
- 4.4.6 All heavy equipment with limited visibility (operator cannot directly or by mirror or other effective device see immediately behind the machine) operated around workers or on a construction site:
- Shall have an audible back-up alarm installed that functions automatically when the vehicle or equipment is put into rear motion.

- All bi-directional equipment shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction.
- Backing up or movement in both directions for bidirectional equipment shall occur only when a signal person communicates that it is safe to do so if alarms or horns are not feasible.

4.5 Operation

- 4.5.1 The Operator of heavy equipment is the only worker permitted to ride the equipment unless the equipment is equipped by the manufacturer for passengers. Manufacturer operator's manual shall be complied with.
- 4.5.2 A person will not operate heavy equipment unless the person has received adequate instruction and training in the safe use of the equipment, and has demonstrated to a qualified supervisor or instructor competency in operating the equipment.
 - Oilers, apprentices, and other operators will not be allowed to operate equipment unless authorized by the Manager.
- 4.5.3 The Operator of heavy equipment will operate the equipment safely, maintain full control of the equipment, and comply with the manufacturer's operator manual and the laws governing the operation of the equipment.
 - Operation of company-owned, leased, or rented vehicles or equipment while under the influence of alcohol or illegal drugs or otherwise impaired is prohibited.
 - Do not operate any equipment beyond its safe load or operational limits.
 - Operator shall not talk on, text, or otherwise use mobile phones while operating heavy equipment.
 - Never use bucket teeth or boom for lifting or moving heavy objects.
- 4.5.4 When heavy equipment is used for lifting or hoisting or similar operations there shall be a permanently affixed notation stating the safe working load capacity of the equipment and the notation shall be kept legible and clearly visible to the operator.
- 4.5.5 A Supervisor or Manager will not knowingly operate or permit a worker to operate heavy equipment which is, or could create, an undue hazard to the health or safety of any person. Where compliance is refused, the Manager or his or her designate should be notified immediately.
- 4.5.6 The Operator of heavy equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement.
 - The Operator is not to leave suspended load, machine or part or extension unattended, unless it has been immobilized and secured against inadvertent movement.
 - Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended.
 - Buckets and blades are to be placed on the ground and with hydraulic gears in neutral when not in use.
 - Brakes shall be set and, as necessary, wheels chocked or equivalent (as applicable) when not in use.
- 4.5.7 The Operator will maintain the cab, floor and deck of heavy equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.
- 4.5.8 If heavy equipment has seat belts required by law or manufacturer's specifications, the Operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

- Seat belts shall be maintained in functional condition, and replaced when necessary to ensure proper performance.
- 4.5.9 All vehicles transporting material or equipment on public roads shall comply with local laws pertaining to weight, height, length, and width. Obtain any permits required for these loads.
- 4.5.10 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.
- 4.5.11 Never exit heavy equipment while it is in motion.
- 4.5.12 Do not ride with arms or legs outside of the truck body of equipment cab.
- Never ride on the outside of a piece of heavy equipment (e.g. in a standing position on the body, on running boards, or seated on side fenders, cabs, cab shields, rear of truck bed, on the load, bucket, etc.).
- 4.5.13 Have vehicle headlights on at all times when driving in the area.
- 4.5.14 Park motor vehicles off the haul roads, or away from the work areas.
- 4.5.15 Do not wear loose clothing or jewelry where there is a danger of entanglement in rotating equipment.
- 4.5.16 Do not enter the swing area of machines such as cranes, heavy drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so. Refer to *S3AM-309-ATT2 Operator Line of Sight*.
- 4.5.17 Stay out of the blind areas around heavy equipment and never assume that the equipment operators have seen you or are aware of your presence.
- 4.5.18 Maintain a distance of at least 2 feet (60 centimeters) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, a spotter shall observe and be in constant communication with the operator to prevent contact.
- 4.5.19 Vibrations from moving traffic or heavy equipment can cause excavations or spoil piles to become unstable.
- Excavation activity shall be conducted according to *SOP S3AM-303-PR1 Excavation*.
 - Equipment not involved in the excavating activity or not required to be in the vicinity shall keep clear. Equipment that shall operate in the vicinity shall maintain appropriate setback distances from edges of excavations or spoil piles.
- 4.5.20 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.
- When ascending or descending grades in excess of 5 percent, loaded equipment shall be driven with the load upgrade.
 - When operating an electric-powered, remote controlled, hydraulic device used for demolishing concrete structures and refractory linings as well as excavating, refer to the *S3AM-309-ATT1 Brokk 180* for more specifics.
- 4.5.21 All heavy equipment shall be operated at safe speeds. Do not drive any vehicle at a speed greater than is reasonable and safe for weather conditions, traffic, intersections, width, and character of the roadway, type of motor vehicles, and any other existing condition.
- 4.5.22 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.
- 4.5.23 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.
- 4.5.24 When feasible, Operators shall travel with the "load trailing", if the load obstructs the forward view of the operator.

- 4.5.25 Slow down and sound horn when approaching a blind curve or intersection. Signal people equipped with 2-way radio communications may be required to adequately control traffic.
- 4.5.26 All haulage equipment / trucks, whose payload is loaded by means of cranes, power shovels, loaders, or similar equipment, shall have a cable shield and/or canopy adequate to protect the operator from shifting or falling material. If protection is not available for the operator, the operator shall leave the vehicle and wait in a designated safe location until it is loaded..
- 4.5.27 Equipment shall be shut down prior to and during fueling.
 - Confirm proper grounding/ bonding between equipment and fuel vehicle prior to fueling operations.
 - During fuel operations confirm fuel nozzle remains in contact with the tank.
 - Do not smoke, use electrical devices or have an open flame present while fueling.
 - Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.
- 4.5.28 Site vehicles will be parked in a designated parking location away from heavy equipment.
- 4.5.29 Operators shall never push/pull "stuck" or "broken-down" equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.
- 4.5.30 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.
- 4.5.31 Equipment left unattended at night adjacent to travelled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (1.8m) (or the regulatory requirement for the work location) to the active roadway.
- 4.5.32 Rubber / pneumatic-tired earthmoving haulage equipment shall be equipped with fenders on all wheels. Mud flaps may be used in lieu of fenders whenever motor vehicle equipment is not designed for fenders.
- 4.5.33 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not to be exceeded.
- 4.5.34 Steering or spinner knobs shall not be attached to steering wheels.
- 4.5.35 High-lift rider industrial trucks shall be equipped with overhead guards.
- 4.5.36 All hot surfaces of equipment, including exhaust pipes or other lines, that present a possible injury or fire hazard, shall be guarded or insulated.
- 4.5.37 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.
- 4.5.38 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.
- 4.5.39 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.
- 4.5.40 In an effort to reduce air emissions, fuel costs, and run-time hours (that can impact equipment warranty), operators shall limit heavy equipment engine idling to not more than five consecutive minutes. Local regulations at the location of the vehicle operation could require less than five consecutive minutes idling time. The idling limit does not apply to:
 - Idling when queuing.
 - Idling to verify that the vehicle is in safe operating condition.

- Idling for testing, servicing, repairing or diagnostic purposes.
- Idling necessary to accomplish work for which the vehicle was designed (cranes, man-lifts, forklifts, etc.)
- Idling required to bring equipment/vehicle to operating temperature, as specified by the manufacturer. Engine heaters shall be used for cold weather starting to avoid engine idling where feasible.
- Idling necessary to ensure safe operation of the vehicle.
- Idling to keep equipment (including windows) clear of ice and snow.
- Idling to provide air conditioning or heat to ensure the health and safety of the operator, but only when seated inside the equipment or vehicle.

4.6 Utilities

- 4.6.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc. Refer to the *S3AM-322-PR1 Overhead Lines* procedure for more specifics.
- 4.6.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:
- Always be aware of surrounding utilities.
 - Confirm all equipment (e.g., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath aboveground utilities.
 - Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc. Refer to *SOP S3AM-303-PR1 Excavation* and *S3AM-331-PR1 Underground Utilities & Subsurface Installation Clearance*.

4.7 Training

- 4.7.1 The Operator or other qualified supervisor will provide all on-site personnel with an orientation to the heavy equipment and its associated hazards and controls.
- 4.7.2 Only designated, qualified personnel shall operate heavy equipment.
- 4.7.3 Operators shall have all appropriate jurisdictional licenses or training to operate a designated piece of heavy equipment.
- 4.7.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an AECOM operator in which case a practical evaluation is required. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.8 Inspection and Maintenance

- 4.8.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel regulatory agencies upon request during work hours.
- 4.8.2 Maintenance records will be maintained on the site or project for heavy equipment.
- 4.8.3 Conduct maintenance as prescribed by the manufacturer in the Operation Manual for each piece of equipment.
- 4.8.4 Servicing, maintenance and repair of heavy equipment will not be done when the equipment is operating.
- Lockout and tagout safety procedures are followed. Refer to *S3AM-325-PR1 Lockout Tagout*.

- Motors are turned off, unless required for performing maintenance or repair.
 - All ground-engaging tools are grounded or securely blocked.
 - Controls are set in a neutral position and brakes are set.
 - Electrically driven equipment is installed with provision for tagging and locking out the controls while under repair.
 - Manufacturer's requirements for maintenance and repair are followed.
 - If continued operation is essential to the process, a safe means of protection shall be provided.
 - Provide and use a safety tire rack, cage, or equivalent protection when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.
- 4.8.5 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use.
- Operators shall not operate heavy equipment that has not been cleared for use.
 - All machinery and mechanized equipment will be verified to be in safe operating condition (refer to *S3AM-309-FM1 Approval of Machinery & Mechanized Equipment*) by a competent person (refer to *S3AM-202-PR1 Competent Person Designation*) within seven days prior to operation on a new site or project. Clearance is valid for up to one year for the given site or project.
 - As applicable, all machinery and mechanized equipment shall be inspected / certified and tested at appropriate intervals as required by the manufacturer and/or regulatory requirements.
- 4.8.6 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the Supervisor/ Manager immediately.
- Defective heavy equipment shall be immediately tagged and taken out of service until repaired.
 - Inspection, maintenance, service and repair records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use *S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist*.
 - Records shall be made available for review upon request. Note: Documents may be electronically stored in the project files.
- 4.9 Fueling and batteries
- 4.9.1 A well-ventilated area shall be used for refueling.
- 4.9.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.
- 4.9.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.
- 4.9.4 If there is potential to spill fuel on hot surfaces, the surfaces shall be permitted to cool down prior to fueling. Any spillage shall be cleaned before starting engine.
- 4.9.5 Spilled fuel shall be cleaned with cotton rags or cloths and disposed of in the proper receptacle; do not use wool or metallic cloth.
- 4.9.6 Open flames, lighted smoking materials, sparking equipment or any other type of ignition source shall remain a minimum of 35' (10.7m) from the fueling area and/or fuel source. This clearance shall be increased if required or conditions warrant.
- 4.9.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.
- 4.9.8 Portable containers to be filled shall be placed directly on the ground or be properly grounded prior to filling to prevent creation of a static charge. Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.
- 4.9.9 Control electrostatic hazards.

- Before activating fuel pump, touch some part of vehicle / equipment to de-energize any static electricity that may be present.
 - The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.
 - Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent build-up of a static charge.
- 4.9.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.
- 4.9.11 Batteries shall be serviced in a ventilated area while wearing appropriate Personal Protective Equipment.
- 4.9.12 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first. Consult the SDS applicable to the battery and/or contents for additional information including; handling, precautions, and first aid measures.
- Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water. Battery storage or maintenance areas shall have readily accessible eye wash stations.
 - Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention shall be sought immediately.
- 4.9.13 When installing a battery, the battery shall be connected ground post last.
- 4.9.14 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.
- 4.9.15 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.
- 4.9.16 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around batteries by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least a minimum of 35 feet (10.7 meters) away from battery-charging stations.

5.0 Records

- 5.1 Inspection, maintenance, service and repair records shall be maintained with the equipment.

6.0 Attachments

- 6.1 [S3AM-309-ATT1](#) [Brokk180 Safety Card](#)
- 6.2 [S3AM-309-ATT2](#) [Operator Line of Sight](#)
- 6.3 [S3AM-309-FM1](#) [Approval of Machinery & Mechanized Equipment](#)
- 6.4 [S3AM-309-FM2](#) [Heavy Machinery Pre-Operation Checklist](#)
- 6.5 [S3AM-309-FM3](#) [Rubber Tire Backhoe Operator Skill Evaluation](#)
- 6.6 [S3AM-309-FM4](#) [Scraper Operator Skill Evaluation](#)
- 6.7 [S3AM-309-FM5](#) [Bull Dozer Operator Skill Evaluation](#)
- 6.8 [S3AM-309-FM6](#) [Dump Truck Operator Skill Evaluation](#)
- 6.9 [S3AM-309-FM7](#) [Roller Compactor Operator Skill Evaluation](#)
- 6.10 [S3AM-309-FM8](#) [Front End Loader Operator Skill Evaluation](#)
- 6.11 [S3AM-309-FM9](#) [Grader Operator Skill Evaluation](#)
- 6.12 [S3AM-309-FM 10](#) [Excavator Operator Skill Evaluation](#)
- 6.13 [S3AM-309-FM11](#) [Water Truck Operator Skill Evaluation](#)

- 6.14 [S3AM-309-FM12 Heavy Equipment Maintenance Inventory](#)
- 6.15 [S3AM-309-FM13 Heavy Equipment Inspection Report](#)

Americas**Approval of Machinery and Mechanized Equipment****S3NA-309-FM1****1.0 General Guidelines**

- 1.1 Subcontractor equipment shall comply with all applicable legislative requirements, local, State, Federal, Provincial, Territorial for motor vehicles and material handling heavy equipment.
- 1.2 Approval shall be obtained for all subcontractor machinery and mechanized equipment within seven calendar days of use on the project site.
- 1.3 As applicable, all machinery and mechanized equipment must be certified and tested at appropriate intervals as required by the manufacturer and/or regulatory requirements.
- 1.4 Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, trackhoes, bulldozers, forklifts, and similar equipment used for the implementation of the project Statement of Work.

2.0 Equipment Safety Inspections

- 2.1 The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.
 - 2.1.1 All machinery and mechanized equipment will be approved to be in safe operating condition (using the attached form) by a competent individual within seven calendar days in advance of operation on a new site or project. This approval is valid for one year for the given site or project.
 - 2.1.2 Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
 - 2.1.3 Inspections shall include, but are not limited to, all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
 - 2.1.4 Drill rigs and related support equipment and vehicles shall be inspected by the driller in charge on a daily basis. These inspections shall be recorded on the Daily Drill Rig Checklist or on equivalent subcontractor forms.
 - 2.1.5 Preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment Standard Operating Procedures.
 - 2.1.6 Only designated qualified persons shall operate and inspect machinery and mechanized equipment.
 - 2.1.7 The contractor shall maintain records of tests and inspections at the site and shall make the records available upon request of the designated authority; the records shall become part of the official project file.
 - 2.1.8 Equipment found to not be in safe operating condition or to have a deficiency that affects the safe operation of the equipment shall immediately be tagged, taken out of service, and its use prohibited until deficiencies have been corrected to a safe condition.
 - 2.1.9 All equipment shall be kept in the exclusion zone until decontaminated within designated decontamination areas.
 - 2.1.10 Equipment with an obstructed rear view must have an audible alarm that sounds when equipment is moving in reverse.

TO: AECOM

DATE:

FROM:

Project Name:

Project Number:

Project Location:

1. This form provides approval of machinery and mechanized equipment to be used on the referenced project for the following work:

Description of equipment work:	
Project site:	
Subcontractor providing equipment: Address:	
Dates (duration) of equipment work:	

2. Inspection and approval of machinery and mechanized equipment, as required by AECOM, has been made within seven calendar days in advance of use on the project site. This approval process shall be repeated for equipment that is used on the project or site for more than one year.

Identification of equipment (make, model, serial no.)		Date of Certification
1		
2		
3		

3. The above listed equipment has been inspected and tested as indicated on this form, and is DECLARED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

Name		Title
Company		
Signature		Date

4. If there are any questions regarding this certification, please contact the following AECOM representative:

Americas

Heavy Equipment Pre-Operation Checklist

S3NA-309-PR1

Project Name/Location:									Project #:								
Equipment # / Name:				Make/Model:					Annual Insp/Cert. Date:								
Hour meter reading:																	
Operator Name/Date																	
✓ = Satisfactory; in working order X = Unsatisfactory; not in working order/damaged N/A = Not Applicable																	
Check the following as appropriate	✓	X	N/A	✓	X	N/A	✓	X	N/A	✓	X	N/A	✓	X	N/A		
Side Shields/Screens/Grab Handles																	
Overhead Guard (ROPS, FOP)																	
Horn / Backup Alarm																	
Lights																	
Gauges / Temperature																	
Parking Brake / Service Brakes																	
Steering / Controls																	
Hydraulic System (full, no leaks)																	
Other Fluids (radiator, washer, etc.)																	
Blast Shields																	
Attachment (bucket, forks, compactor, jib)																	
Lift-arm Device																	
Tires / Tracks / Treads (visual)																	
Seat belt / Operator Seat Bar																	
Windows / Mirrors / Wipers																	
Exhaust Components																	
Fuel System (lines secure/no leaks)																	
Electrical Lines																	
Fire Extinguisher																	
Spark arrestor / Positive air shutoff																	
Safety signs																	
General condition (exterior clean/intact)																	
General condition (interior clean/tidy)																	
Quantity of Fuel Added																	
Quantity of Oil Added																	
Operator Signature																	
Comments (including any corrections):																	

Americas

Rubber Tire Backhoe Operator Skill Evaluation

S3NA-309-FM3

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
This equipment is used for primarily for excavation, although it may occasionally be used for other miscellaneous tasks for which crane or stick type equipment is required.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities	<input type="checkbox"/> Yes <input type="checkbox"/> No
	b) Pre-shift inspection check list (<i>S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent) <ul style="list-style-type: none"> i) Check equipment for loose bolts, leaks; oil, hydraulic and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational <ul style="list-style-type: none"> a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires if applicable g) Glass, wipers h) Gauges, including temperature, oil, and fuel i) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property 	
	c) Maintain three points of contact while entering and exiting the equipment	
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Excavating techniques <ul style="list-style-type: none"> a) Benching, sloping b) Spoil removal from side wall c) Back filling operations d) Aware of surroundings and personnel near the swing radius of boom 	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Can arrange controls and boom for travel	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Speed in relation to terrain (controlled speed)	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Stock piling with front end bucket	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Loading truck bed with bucket	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	Parking and shut down procedures <ul style="list-style-type: none"> a) Equipment line-up <ul style="list-style-type: none"> i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Set all park brakes d) Lower bucket to ground e) Place and position wheel chocks f) Perform a general walk around looking for items for maintenance 	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Scraper Operator Skill Evaluation

S3NA-309-FM4

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Drives a tractor to pull a steel bowl-like or box-like scoop (scraper), mounted on wheels, which scrapes up earth and transports it to a designated place; manipulates a series of levers to lower cutting edge of scraper into the ground, to raise cutting edge when scraper is full, to empty scraper		
STEPS	KEYPOINTS	SATISFACTORY
1.	Demonstrated abilities a) Pre-shift inspection check list (<i>S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluids and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2.	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3.	Loading techniques a) Use of apron b) Use of cutting edge c) Push loading d) Push/pull loading e) Use of ejector	<input type="checkbox"/> Yes <input type="checkbox"/> No
4.	Shifting and hauling	<input type="checkbox"/> Yes <input type="checkbox"/> No
5.	Rough cut and fill	<input type="checkbox"/> Yes <input type="checkbox"/> No
6.	Spreading material	<input type="checkbox"/> Yes <input type="checkbox"/> No
7.	Fine grading	<input type="checkbox"/> Yes <input type="checkbox"/> No
8.	Obtaining compaction	<input type="checkbox"/> Yes <input type="checkbox"/> No
9.	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Lower apron d) Lower bowl to the ground e) Place and position wheel chocks f) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Bull Dozer Operator Skill Evaluation

S3NA-309-FM5

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u> 		
Operates a large tractor with a concave steel blade or push block mounted in front of the chassis to level, distribute and push earth. This equipment may be used to push earth carrying equipment. A ripper attachment may be used for ripping the earth prior to loading the scraper. Operator regulates height of blade or push block from ground and may help in adjustments to equipment as needed		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection check list (<i>S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tracks g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Audible horn v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Pushing techniques a) Use of push blade b) Loading of push load equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Use of ripper shanks	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Rough cut and fill	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Spreading material	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Fine grading	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	Obtaining compaction by tracking in material	<input type="checkbox"/> Yes <input type="checkbox"/> No
9)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Lower rippers d) Lower blade to the ground e) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Dump Truck Operator Skill Evaluation

S3NA-309-FM6

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Drives a heavy-duty gasoline or diesel-powered truck used in hauling material to fill areas or dump sites. Truck is either tandem rear axle type, or tractor truck, single or tandem axle, pulling a trailer, articulated or fixed axle haul truck. May service and make necessary adjustments for proper operation of equipment.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection (S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational (1) Brakes (2) Lights (3) Back-up alarms (4) Hand rails & ladders (5) Seat belts (6) Tires (7) Glass, wipers (8) Gauges, including temperature, oil, air and fuel (9) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park or side line a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Truck Weighing a) Tare weights b) Gross Weights	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Loading Techniques a) Parking into load patterns b) Bed preparation for material c) Remains in cab in loading area and while being loaded	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Shifting and Hauling	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Stockpiling	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Backing with the use of mirrors	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	Dumping/Spreading Material a) Fill material b) Base course material c) Surface materials d) Asphalt e) Lowers truck bed (dump trucks) or dump chutes (belly dumps) f) Follows spotters directions (when applicable)	<input type="checkbox"/> Yes <input type="checkbox"/> No
9)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Use park brake d) Place and position wheel chocks e) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Dump Truck Operator Skill Evaluation (S3NA-309-FM6)

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Americas

Roller / Compactor Operator Skill Evaluation

S3NA-309-FM7

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Operates a self-propelled gasoline or diesel machine, which has pneumatic tires, steel wheels/drums used to compact earth fills, flexible bases and all types of materials. Rollers are also used for compaction to achieve a desired or specified density. Rides on the machine platform and moves lever and pedals or throttles to control and guide machine.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection check list (<i>S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires, if applicable g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Rolling techniques to obtain compaction a) Use of controls b) Vibratory controls c) Turns and maneuvers d) Aware of surroundings	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Rolling patterns a) Staggered patterns with other rollers	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Place and position wheel chocks d) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Front End Loader Operator Skill Evaluation

S3AM-309-FM8

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Operates rubber tire or crawler type tractor with attached bucket on front end. Moves lever to raise, lower and dump contents of bucket. Machine used to load materials from stockpiles, excavation, loading trucks.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection check list (S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Loading techniques a) Use of bucket and controls b) Crowding the pile c) Pump loading, etc. d) Loading patterns e) Loading trucks f) Loading scrapers	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Control handling of soils	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Shifting and hauling	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Stockpiling	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Mixing and moisture conditioning	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	Feeding crusher	<input type="checkbox"/> Yes <input type="checkbox"/> No
9)	Rough cut and fill	<input type="checkbox"/> Yes <input type="checkbox"/> No
10)	Spreading material	<input type="checkbox"/> Yes <input type="checkbox"/> No
11)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Lower bucket to the ground d) Place and position wheel chocks e) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Grader Operator Skill Evaluation

S3AM-309-FM9

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
<p>Rides in cab of grader and moves levers and steering wheel to guide machine and regulate the scraper blade or ripper. Blade is mounted on a carrying and turning circle at the front of the machine. Equipment is used to level or mix soils and aggregates to grade and to lay asphalt and flexible base materials and clean haul roads.</p>		
STEPS	KEYPOINTS	SATISFACTORY
1)	<p>Demonstrated abilities</p> <p>a) Pre-shift inspection check list (S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist or equivalent)</p> <p>i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water</p> <p>ii) Make sure area around the equipment is clear of people and other equipment</p> <p>iii) Check for fire extinguisher</p> <p>iv) Make sure that the following equipment is operational</p> <p>a) Brakes</p> <p>b) Lights</p> <p>c) Back-up alarms</p> <p>d) Hand rails & ladders</p> <p>e) Seat belts</p> <p>f) Tires</p> <p>g) Glass, wipers</p> <p>h) Gauges, including temperature, oil, air and fuel</p> <p>v) Notify supervision of any equipment that is not operational</p> <p>vi) Wheel chocks</p> <p>vii) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property</p> <p>b) Maintain three points of contact while entering and exiting the equipment</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	<p>Leveling and scraping techniques</p> <p>a) Use of levers</p> <p>b) Use of cutting edge</p> <p>c) Controlling front wheel tilt</p> <p>d) Controlling crab motion</p> <p>e) Use of ripper</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Shifting and traveling with loaded moe board	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Rough cut and fill	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Spreading material	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Fine grading	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	<p>Parking and shut down procedures</p> <p>a) Equipment line-up</p> <p>i) Straight line</p> <p>ii) Allow easy access for maintenance and servicing</p> <p>b) Turn off all accessories</p> <p>c) Lower moldboard to the ground</p> <p>d) Place and position wheel chocks</p> <p>e) Perform a general walk around looking for maintenance items</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Excavator Operator Skill Evaluation

S3AM-309-FM10

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Operates a rubber tire or crawler type tractor with an attached bucket on front end. Moves a lever to raise and lower and dump contents of bucket. Machine is used to load materials from stockpiles, excavation, loading trucks.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection check list (<i>S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Wheel chocks (for rubber tire type excavators) v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Loading techniques a) Use of bucket and controls b) Crowding the pile c) Pump loading, etc. d) Loading patterns e) Loading trucks f) Loading scrapers	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Control handling of soils	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Shifting and hauling	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Stockpiling	<input type="checkbox"/> Yes <input type="checkbox"/> No
7)	Mixing and moisture conditioning	<input type="checkbox"/> Yes <input type="checkbox"/> No
8)	Feeding crusher	<input type="checkbox"/> Yes <input type="checkbox"/> No
9)	Rough cut and fill	<input type="checkbox"/> Yes <input type="checkbox"/> No
10)	Spreading material	<input type="checkbox"/> Yes <input type="checkbox"/> No
11)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Lower bucket to the ground d) Place and position wheel chocks (rubber tire type excavator) e) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Water Truck Operator Skill Evaluation

S3AM-309-FM11

Date _____ Employee Name _____ Evaluator _____

<u>Description:</u>		
Drives articulated, pull type, single and two axle type water trucks. Waters roads, fills, and cut areas to suppress dust.		
STEPS	KEYPOINTS	SATISFACTORY
1)	Demonstrated abilities a) Pre-shift inspection check list (<i>S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist</i> or equivalent or DOT daily inspection if applicable) i) Check equipment for loose bolts and leaks; check oil, air, hydraulic fluid and water ii) Make sure area around the equipment is clear of people and other equipment iii) Check for fire extinguisher iv) Make sure that the following equipment is operational a) Brakes b) Lights c) Back-up alarms d) Hand rails & ladders e) Seat belts f) Tires g) Glass, wipers h) Gauges, including temperature, oil, air and fuel i) Wheel chocks v) Notify supervision of any equipment that is not operational vi) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property b) Maintain three points of contact while entering and exiting the equipment	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Identification of equipment controls	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Loading Techniques a) Minimizes spillage b) Uses chocks or turns into berm	<input type="checkbox"/> Yes <input type="checkbox"/> No
4)	Shifting and Hauling	<input type="checkbox"/> Yes <input type="checkbox"/> No
5)	Properly applies water to ramps/corners	<input type="checkbox"/> Yes <input type="checkbox"/> No
6)	Backing with the use of mirrors	<input type="checkbox"/> Yes <input type="checkbox"/> No
11)	Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Use park break d) Place and position wheel chocks e) Perform a general walk around looking for maintenance items	<input type="checkbox"/> Yes <input type="checkbox"/> No

Any items checked 'No' require additional training of operator and the skill evaluation to be repeated until the operator successfully achieves a satisfactory status in all skill identified.

Americas

Heavy Equipment Maintenance Inventory

S3AM-309-FM12

EQUIPMENT (MAKE, MODEL, SERIAL #)	EQUIPMENT OWNER	EQUIPMENT STATUS (ON HIRE, ACTIVE, DECOMMISSIONED)	FREQUENCY OF SERVICE	SERVICE TYPE	MANUFACTURER'S STANDARDS	INDUSTRY STANDARDS	LEGISLATED REQUIREMENTS	LOCATION OF EQUIPMENT

S3NA-309-FM13

[illegible]

Brokk 180

S3NA-309-ATT1

1.0 Objective/Overview

- 1.1 The Brokk 180 is an electric-powered, remote controlled, hydraulic device used for demolishing concrete structures and refractory linings as well as excavating. This machine includes attachments designed exclusively for demolishing work (e.g., grapple, bucket, hydraulic hammer, etc.). By using the remote control unit, an operator can move the machine and attachments in different directions and speeds from afar.

2.0 Potential Hazards

- 2.1 Flying debris
- 2.2 Crush/impact/pinch from extendable boom, tracks, and tipping over
- 2.3 Struck-by
- 2.4 Electricity (subsurface utilities when excavating)
- 2.5 Gas lines (subsurface utilities when excavating)
- 2.6 Noise



3.0 Safe Operating Guidelines

- 3.1 Prior to use, complete a pre-operation inspection to determine if the unit is in safe working condition.
- 3.2 Position the unit to safely perform the intended task, then deploy the outriggers to stabilize the unit.
- 3.3 Confirm that the operator knows what the lifting capacity is; do not exceed the lifting capacity.
- 3.4 Complete a subsurface utility clearance prior to excavating.
- 3.5 Operator should define a swing radius area and exclude workers from the area. Establish a minimum 15-foot (4.5-meter) clearance around the unit while operating.
- 3.6 Do not allow debris to build up around the unit. Maintain good housekeeping practices.
- 3.7 Prior to removing debris from under the boom, stop, disengage the unit, and position the boom so that the attachment is at rest on the ground.
- 3.8 Personnel operating the unit with the remote control device will be properly trained and certified by a competent person.
- 3.9 The operator will be able to maintain line of sight visual contact with the unit at all times to assess hazards and site security.
- 3.10 Maintenance in excess of preventive maintenance activities (e.g., lubrication, replenishing fluids, etc.) will be performed by manufacturer personnel ONLY.
- 3.11 All operations will comply with the manufacturer's recommended policies.

4.0 Training Requirements

- 4.1 Review of applicable Standard Operating Procedures.
- 4.2 Complete knowledge and understanding of remote control functions.
- 4.3 Review and follow manufacturers' recommended policies and practices.

5.0 Personal Protective Equipment

- 5.1 Class II (minimum) American National Standards Institute/Canadian Safety Association Safety Vest
- 5.2 Hard Hat
- 5.3 Safety Toe Boots
- 5.4 Safety glasses with side shields
- 5.5 Hearing protection (ear plugs and/or ear muffs)
- 5.6 Leather gloves

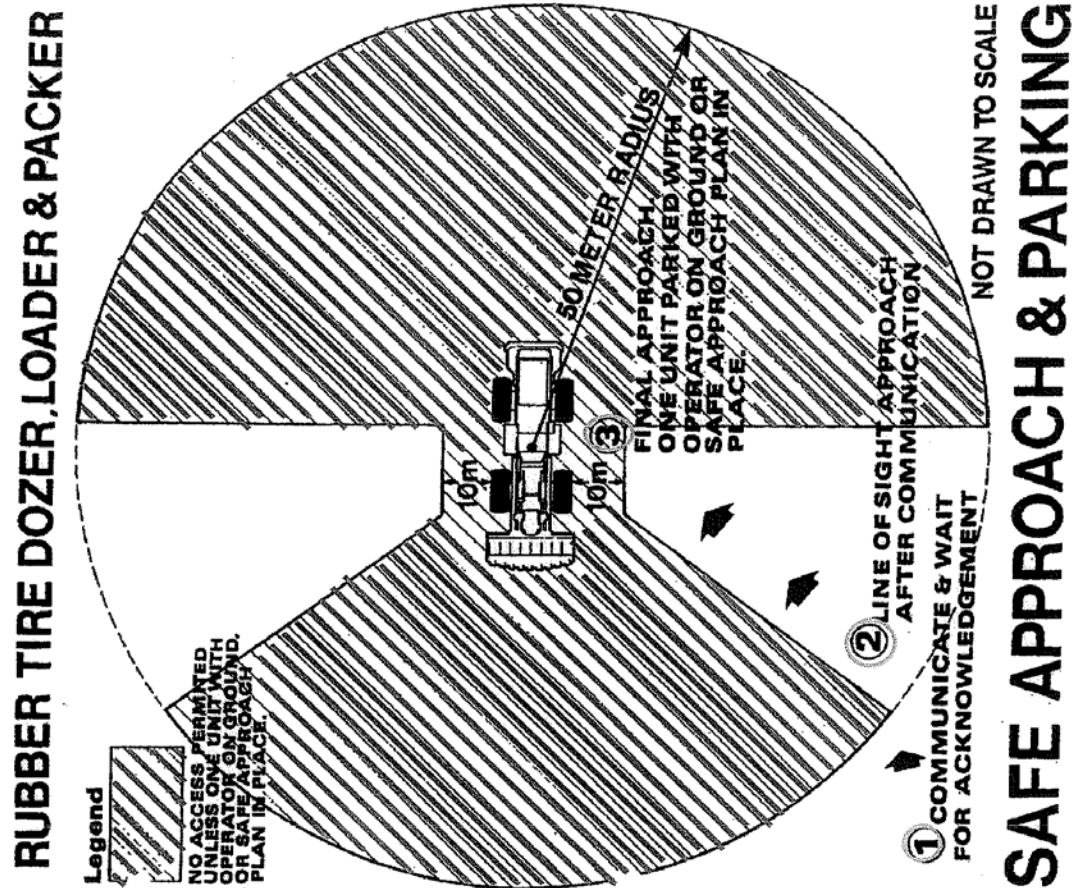
6.0 Other Safety Tips

- 6.1 Never stand under a raised boom.
- 6.2 Pay close attention to power cords for potential tripping hazard and equipment entanglement.

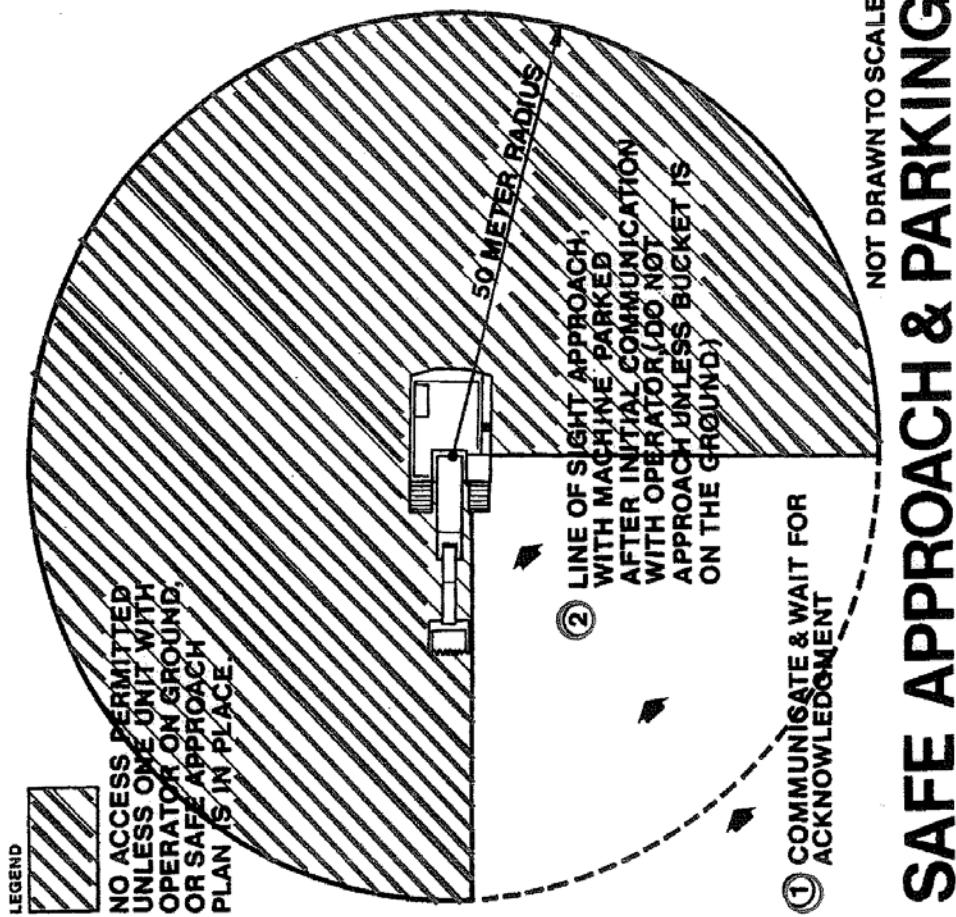
Americas

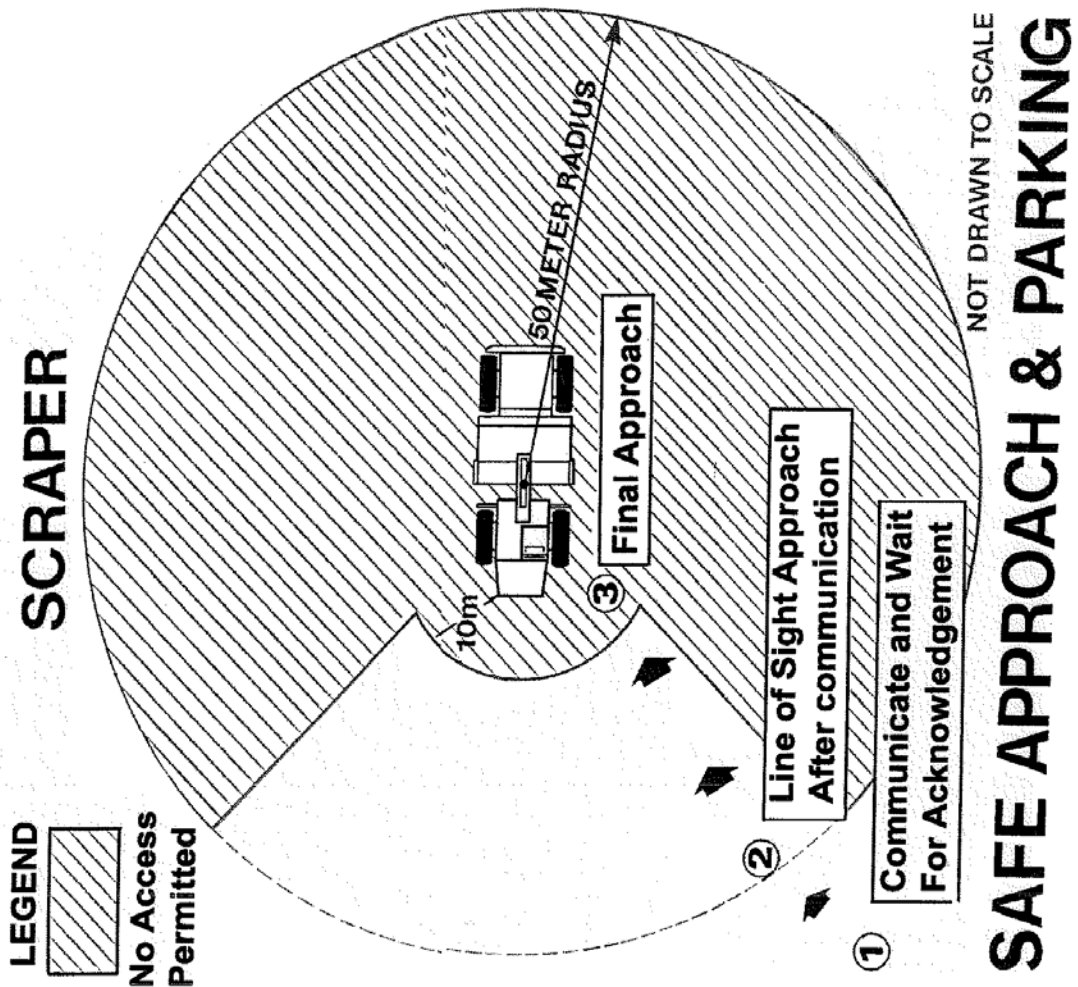
Operator Line of Sight

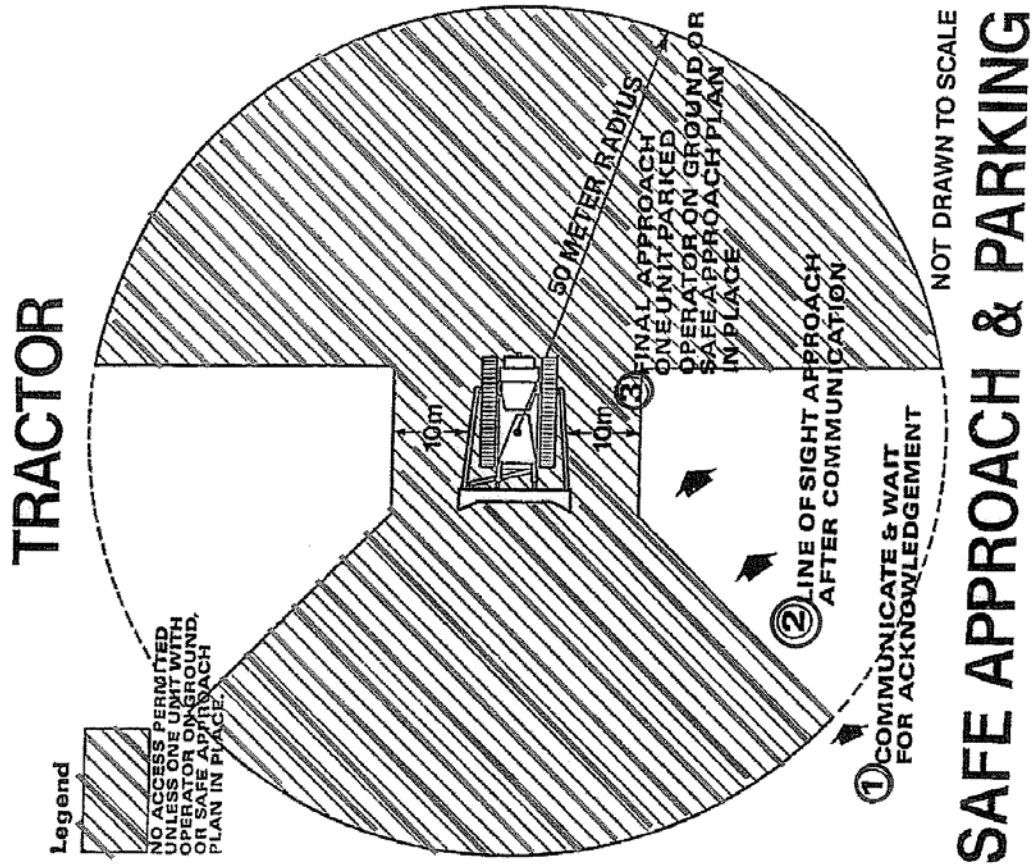
S3NA-309-ATT2

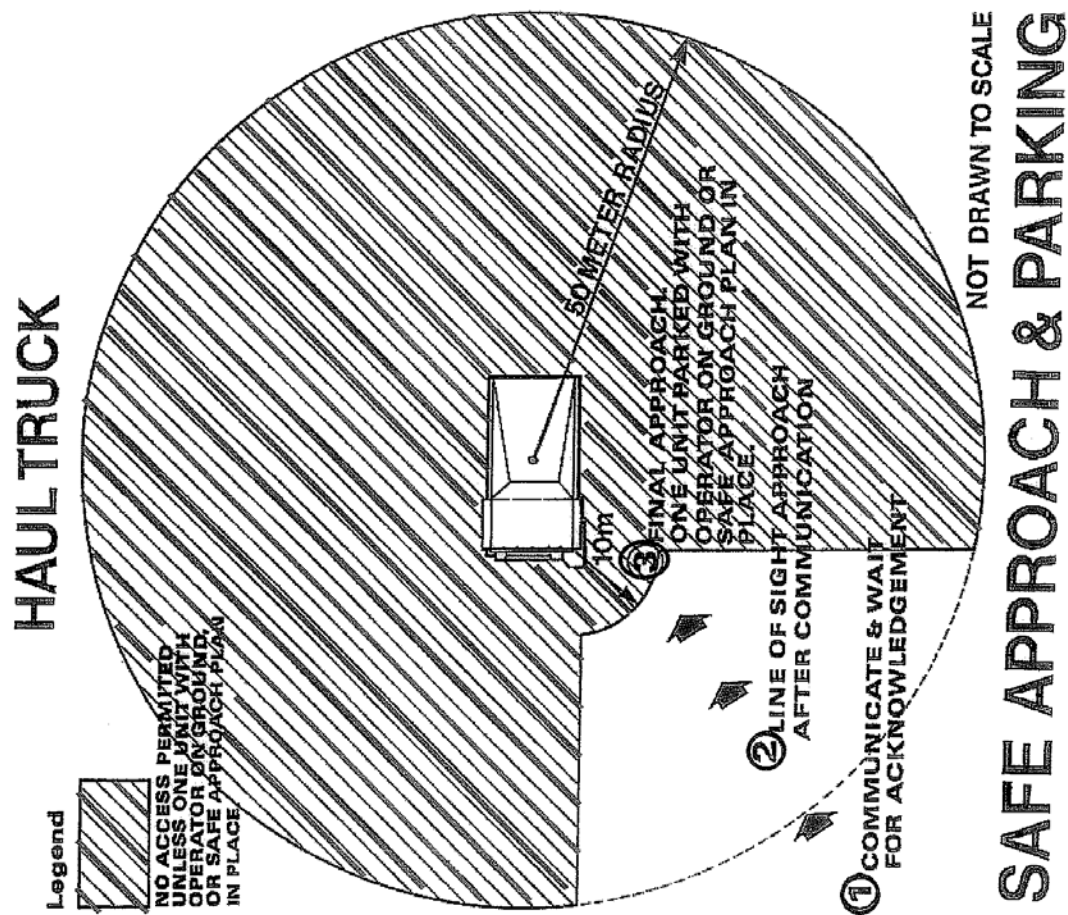


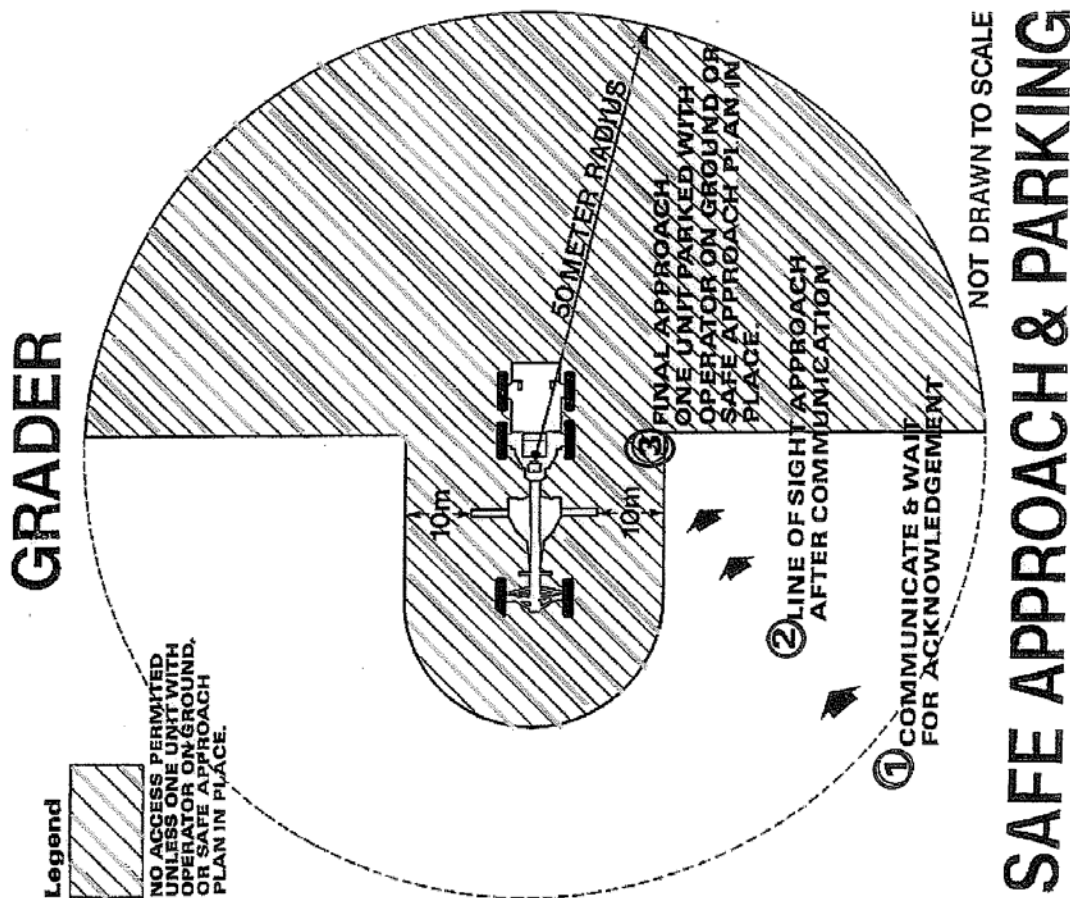
HYDRAULIC EXCAVATOR



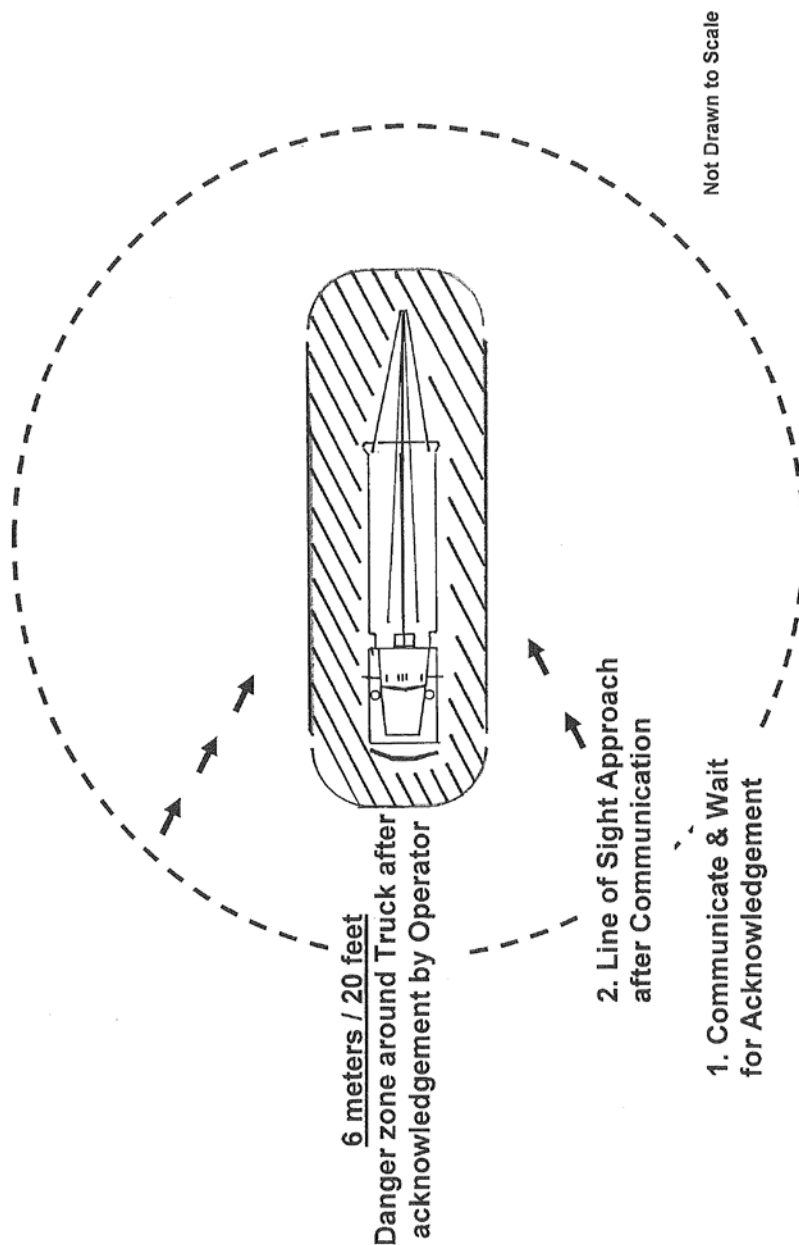








Bed / Pole Truck



SAFE APPROACH & PARKING

Cranes & Lifting Devices

S3AM-310-PR1

1.0 Purpose and Scope

This procedure establishes the minimum requirements for rigging, hoisting, and crane operations.

- 1.1 This procedure is intended to establish general practices for the operation and maintenance of cranes, other lifting devices and rigging equipment in order to minimize the potential for personal injury and property damage. These general practices shall be supplemented by applicable regulatory requirements, and any practices, procedures, and/or operational requirements outlined by the crane, lifting device or rigging equipment manufacturer.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

Refer to *S3AM-310-ATT1 Definitions* for a more comprehensive list.

- 2.1 **ASM** – American Society of Mechanical Engineers
- 2.2 **Assembly/Disassembly (A/D) Director** – An individual who meets this subpart's requirements for an A/D Director, irrespective of the person's formal job title or whether the person is non-management or management personnel. A/D will be directed by a person who meets the criteria for both a competent person and a qualified person or by a competent person who is assisted by one or more qualified persons. If the assembly/disassembly is being performed by only one person, that person will meet the criteria for both a competent person and a qualified person. For purposes of this standard, that person is considered the A/D Director.
- 2.3 **Controlling Entity** – An employer that is a prime contractor, general contractor, construction manager, constructor or any other legal entity that has the overall responsibility for the construction of the project, including planning, quality, safety and completion.
- 2.4 **Crane** – Any power-operated equipment that can hoist, lower, and horizontally move a suspended load.
- 2.5 **Critical lifts** – Loads classified as requiring a formal, written plan. A critical lift plan is defined as a non-routine crane lift requiring detailed planning and additional or unusual safety precautions. Critical lifts include:
 - Lifts made when the load is greater than 75 percent of the rated capacity of the crane in the configuration that the lift will be made;
 - Lifts that require the load to be lifted, swung, or placed out of the operator's view;
 - Lifts made with more than one crane or hoisting device;
 - Lifts involving non-routine or technically difficult rigging arrangements;
 - Lifts of long lead time permanent materials;
 - Lifts that involve lifting loads over structures or equipment;
 - Lifts taking place in a confined or limited access areas;
 - Hoisting personnel with a crane or derrick; or
 - Any lift which the lift supervisor, operator, or other management personnel believes should be considered critical.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training

- 3.2 S3AM-202-PR1 Competent Person Designation
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM 209 PR1 Risk Assessment & Management
- 3.5 S3AM-218-PR1 Permit to Work
- 3.6 S3AM-304-PR1 Fall Protection
- 3.7 S3AM-309-PR1 Heavy Equipment
- 3.8 S3AM-322-PR1 Overhead Lines
- 3.9 S3AM-323-PR1 Aerial Work Platforms

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager (includes Supervisors)

- Responsible for confirming that all aspects of this procedure are followed and adhered to by all AECOM personnel.
- Confirm appropriate training of personnel to be involved in lifting operations.
- Confirm all necessary information is communicated to all personnel involved or affected.
- Confirm all applicable documentation is completed prior to applicable tasks commencing.
- Participate in the approval of the Critical Lift Plan.

4.1.2 Safety, Health and Environment (SH&E) Manager

- Establishing requirements regarding compliance with applicable jurisdictional safety regulations and communicating these requirements to AECOM management.
- Participate in the approval of the Critical Lift Plan.
- Assist as required, in any inspections, audits or investigations.

4.1.3 Competent Person

- Confirm appropriate training and experience to be designated a competent person. Refer to *S3AM-202-PR1 Competent Person Designation*.
- Perform inspections of cranes, lifting equipment, and rigging as required.
- Identify and assess risk associated with hazards (e.g. wind, suspended loads, workers entering lift zone, etc.) in order to determine appropriate action.
- Conduct and/or supervise load tests as required.
- Supervise the crane or lifting device operation.
- Determine if it is necessary to reduce rated capacity, and determine appropriate load position, boom location, ground support, travel route, distance from overhead obstructions, and speed of movement necessary to ensure safety.

4.1.4 Crane Operator

- Maintain appropriate training / certification / license (as required) by the appropriate regulatory authority. Documentation of certification must be carried by the operator while operating a crane.

- Have practical experience and technical knowledge of pre-operation checks, operator controls, engine start-up, computer set-up and checks, crane operation, inspection, maintenance, characteristics, limitations, and post operation checks on specific cranes
- Be completely familiar with and operate the crane according to the crane's operating manual and load chart. The operator must understand the correct meaning of all notes and be capable of calculating the crane's net capacity under all possible conditions and for every possible configuration of the machine
- Inspect the crane as prescribed by both regulation and the manufacturer.
- Be able to communicate when signals and instructions are given by radio or hand. If any signals are not understood or communication disrupted, the operator shall stop all crane movement.
- Approve the Lift Classification and, as applicable, sign-off on the Critical Lift Plan and Personnel Platform Lifting form.

4.2 General Requirements

4.2.1 Planning is the key to successful and safe hoisting operations and the prevention of accidents and incidents. Proper planning includes, at a minimum:

- Industrial site or project specific SH&E Plan. Refer to *S3AM-209-PR1 Risk Assessment & Management*.
- Verification of training appropriate to employee's roles in the lift.
 - Managers will confirm that crane operators, signal persons, and riggers are certified/qualified.
 - AECOM personnel will not operate powered cranes without direct approval from the Manager, and SH&E Manager.
- Development of a Task Hazard Assessment (THA) for each of the tasks to be performed during each lift.
- As applicable, assessing ground conditions, weather conditions and power line safety in the lift pre-planning.
- Properly classifying the lift. Complete *S3AM-310-FM2 Lift Classification*, or equivalent, for every lift or series of lifts to determine the type of lift to be conducted.
 - This includes correctly identifying when a lift is considered "critical," as defined by this procedure.
 - The lift classification form shall be completed based on the highest capacity lift (greatest % of the load chart). If the crane configuration and lift considerations change, another Lift Classification Form is required.
 - Preparation for critical lifts shall include completing *S3AM-310-FM3 Critical Lift Plan* or equivalent.
 - If the critical lift involves lifting of personnel, *S3AM-310-FM11 Personnel Platform Lifting* or equivalent shall be completed.
 - Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
- The results of hazard assessments, required permits, any additional procedures and documentation (e.g. boom truck checklist, engineered lift plan, etc.) associated with the work and the proposed lift shall be communicated to those who will be involved (including client representatives) during the regular tailgate meeting and/or a pre-lift meeting.

- Concerning worksites in which other employers control concurrent operations and SH&E issues related to the worksite, the Manager shall coordinate with the Controlling Entity and/or those conducting concurrent operations to confirm appropriate control measures are in place to protect employees from the hazards associated with activities to be performed.
 - Coordination shall occur prior to work commencing, periodically thereafter, and as necessary given changes in scope and/or working conditions.
 - Affected employees (including managers and supervisors) shall seek to participate in all site SH&E meetings related to concurrent operations.
- 4.2.2 Cranes and lifting devices shall be designed, constructed and tested in accordance with the standards applicable to the given jurisdiction (e.g. ASME, CSA).
- 4.2.3 Cranes and lifting devices shall be inspected and maintained according to manufacturer and regulatory specifications.
 - Any deficiencies or unsafe conditions identified in an inspection shall be solved (repaired, altered, replaced) and appropriately verified as safe for operation before the hoisting equipment is placed in service.
 - Personnel conducting repairs or alterations shall be qualified to repair or alter the specific equipment.
 - The equipment's logbook shall be completed and reflect any inspections, repairs, testing and maintenance completed.
 - The equipment owner or the party responsible for the operation of the equipment shall confirm that an up to date logbook is maintained and readily available for review by the operator or any person requiring maintenance information on the equipment.
- 4.2.4 Work area
 - The passing of loads over client facility equipment, trailers, public roads, and sidewalks shall only be done if the necessary precautions have been taken for the safety of all workers and other persons.
 - When operating conditions are such that the boom of the crane swings over property lines or operating transportation systems, the owners of adjacent properties or systems shall be consulted. A diagram should be prepared detailing the proposed swing paths for the crane.
 - Work area control. Prior to equipment operation, the manager (or his/her designee) shall either:
 - Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas (lift zone, swing radius, path of travel, landing zone, etc.); or
 - The hazard areas shall be clearly marked by a combination of warning signs and high-visibility markings on the equipment that identify the hazard areas. In addition, the manager (or his/her designee) shall train the workers to understand what these markings signify.
- 4.2.5 The operator shall know total weight of every load being lifted, operating radius for lift as well as the maximum lift height and final position of the load.
- 4.2.6 Confirm the lifting equipment and rigging capacities are not exceeded.
- 4.2.7 All hooks on hoisting equipment shall be equipped with safety hooks.
- 4.2.8 All rigging shall be properly maintained and stored according to manufacturer's specifications.

- Inspect all rigging to be used (i.e. hooks, wire rope, chains, slings, etc.) for deficiencies (i.e. bird-caging, broken wires, abrasion, cuts, nicks, bent links, bent hooks, etc.), before each use and at appropriate intervals.
 - Deficient equipment shall be removed from service, tagged out and/or reuse prevented (e.g. slings cut). If in doubt, do not use. Refer to *S3AM-310-ATT3 Rigging*.
- 4.2.9 Only loads that have been properly rigged or have been placed in containers designed for hoisting may be lifted.
- 4.2.10 Loads should only be rigged for hoisting by qualified persons.
- 4.2.11 Determine the center of gravity or point of balance. All loads shall be freely suspended over the load's center of gravity and clear to lift, avoiding any possible shock or impact load, as well as any obstructions or boom clearance concerns.
- 4.2.12 Utilize taglines to control load movement:
- If tagline usage poses a safety hazard this shall be reflected in the planned procedure and the task hazard assessment, and a short line of suitable length shall be attached to allow the worker to catch the load.
 - If electrical hazards are present the tag line shall be non-conductive.
- 4.2.13 Watch for the roll or swing of the load:
- As immediate correct identification of center of gravity may not be possible, swing or roll of the load due to the load line not positioned directly above center of gravity may occur.
 - Anticipate the direction of the swing or roll and work away from it.
- 4.2.14 Confirm body is never placed between material, equipment or any stationary object and the load swing. Stay away from stacked material that may be knocked over by a swinging load.
- 4.2.15 Confirm all personnel stand clear from the load being lifted and the path of travel or swing path. Utilize suitable signage and/or barricading.
- 4.2.16 Loads shall not pass over personnel, occupied buildings or critical operating facilities.
- 4.2.17 Look over the area where the load is to be positioned. Remove unnecessary blocks or other objects that might fly up if struck by the load.
- 4.2.18 Never leave a load suspended when the lifting device or crane is unattended.
- 4.2.19 Never permit anyone to ride the lifting hook or the load.
- 4.2.20 When lowering or setting the load, be sure feet and all other body parts are out from under the load.
- Set the load down easily and slowly.
 - All loads transported by sling shall be grounded and/or cables touch the ground prior to personnel contacting the rigging. This is to prevent a discharge of electrical current that can generate during transport. Under some conditions the current can arc up to 8 inches (20 centimeters).
 - Confirm load will not shift before removing rigging.
 - Loose loads will be blocked before unhooking.
- 4.3 Ground Conditions
- 4.3.1 This section does not apply to side-boom cranes.
- 4.3.2 Do not assemble or use lifting devices or cranes unless ground conditions are firm, drained (except for marshes/wetlands), and graded to a sufficient extent that, in conjunction with the use of

supporting materials (if necessary), the equipment manufacturer's specifications for adequate support and degree of equipment level are met.

- 4.3.3 Controlling entity means a prime contractor, general contractor, or construction manager, or any other legal entity having the overall planning, quality, and completion responsibility for the construction of the project. The controlling entity shall:
- Confirm that ground preparations necessary to meet the requirements in 4.3.1 of this section are provided.
 - Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) that are identified in documents (such as site drawings, as-built drawings, and soil analyses) if they are available to the controlling entity.
- 4.3.4 If the assembly/disassembly (A/D) supervisor determines that ground conditions do not meet the requirements for safe lifting, that applicable manager (or his/her designee) shall notify the controlling entity regarding the ground preparations that are needed.

4.4 Crane Inspection

4.4.1 Initial & Annual (Comprehensive)

- Prior to using any cranes, and at least every 12 months thereafter, an Initial/Annual Inspection and a Crane Load Test shall be conducted on such equipment.
 - *S3AM-310-FM1 Initial & Annual Crane Inspection* or equivalent shall be completed.
 - All initial and annual crane inspections shall be carried out by a Professional Engineer licensed to practice in the jurisdiction, or where applicable by legislation, by a qualified person designated by the Engineer. .
- Identified deficiencies shall be corrected and inspected by the professional engineer or qualified person.
- Cranes involved in misadventure (i.e. shock load, electrical contact, etc.) that results in suspicion of potential or actual damage shall undergo a comprehensive inspection by a professional engineer or, as permitted by the applicable jurisdiction, a qualified person, and be verified as safe for operation prior to use.
- Cranes that have been idle for 3 months or more shall be inspected by a qualified person using *S3AM-310-FM1 Initial & Annual Crane Inspection* or equivalent.
- No crane shall be put into use before an inspection has been completed and absence of defects or hazards has been verified.

4.4.2 Modified Equipment

- Lifting devices and cranes that have modifications or additions that affect the safe operation of the equipment (such as modifications or additions involving a safety device or operator aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) or capacity shall be inspected by a qualified person (e.g. professional engineer) after such modifications/additions have been completed and prior to initial use. The inspection shall meet the following requirements:
 - Confirm that modifications or additions have been done in accordance with the approval obtained.
 - Prior to initial use, and under the direction of a qualified person, load-test all lifting devices and cranes in which load-sustaining parts have been altered, replaced, or repaired. The replacement of wire rope is specifically excluded from this requirement; however, a functional test of the crane under a normal operating load will be made prior to putting a crane back into service.

4.4.3 Repaired or Adjusted Equipment

- Lifting devices and cranes that have had a repair or adjustment relating to safe operation (such as a repair or adjustment to a safety device or operator aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) shall be inspected by a qualified person after such a repair or adjustment has been completed, prior to initial use. The inspection shall meet the following requirements:
 - The qualified person will determine if the repair/adjustment meets manufacturer's equipment criteria.
 - Prior to use after repair or adjustment of equipment, all lifting devices and cranes in which load-sustaining parts have been altered, replaced, or repaired shall be load-tested by, or under the direction of, a qualified person. The replacement of wire rope is specifically excluded from this requirement; however, a functional test of the crane under a normal operating load will be made prior to putting a crane back into service.

4.4.4 Post-Assembly

- Upon completion of assembly, the equipment shall be inspected by a qualified person to assure that it is configured in accordance with the manufacturer's equipment criteria.
- Do not use equipment until an inspection under this paragraph demonstrates that the equipment is configured in accordance with the applicable criteria.

4.4.5 Each Shift (Daily)

- A competent person shall begin a visual inspection prior to each shift or operation.
- Document using *S3AM-310-FM4 Daily Crane Inspection*, or equivalent, to provide adequate documentation of the inspection. The inspection will consist of observation for apparent deficiencies.
- Disassembly is not required as part of this inspection unless the results of the visual inspection or trial operation indicate that further investigation necessitating disassembly is needed.
- Determinations made in conducting the inspection will be reassessed in light of observations made during operation.

4.4.6 Monthly

- Each month the crane is in service, it shall be inspected by a qualified person using *S3AM-310-FM5 Monthly Crane Inspection*, or equivalent.
- Equipment shall not be used until an inspection under this paragraph demonstrates that no deficiencies are found.

4.4.7 Any part of the manufacturer's procedures regarding inspections relating to safe operation (e.g. safety device or operator aid, critical part of a control system, load-sustaining structural components, load hook, or in-use operating mechanism) that is more comprehensive or has a more frequent schedule than the requirements of this section will be followed.

4.4.8 Documentation

- Maintain all inspection forms on file at the job site for review by interested parties for the duration of the project.

4.5 Wire Rope Inspection

4.5.1 Shift Inspection

- A competent person will conduct a visual inspection of wire ropes prior to each shift. They will observe wire ropes (running and standing) that are reasonably likely to be used during the shift

for apparent deficiencies, including those listed below. Untwisting (opening) of wire rope or booming down is not required as part of this inspection.

- Apparent Deficiencies
 - Category I
 - Significant distortion of the wire rope structure such as kinking, crushing, unstranding, bird caging, signs of core failure, or steel core protrusion between the outer strands.
 - Significant corrosion.
 - Electric arc (from a source other than power lines) or heat damage.
 - Improperly applied end connections.
 - Significantly corroded, cracked, bent, or worn end connections (such as from severe service).
 - Category II
 - Visible broken wires, as follows:
 - a. In running wire ropes: Six randomly distributed broken wires in one rope lay, or three broken wire in one strand in one rope lay, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.
 - b. In rotation-resistant ropes: Two randomly distributed broken wires in six rope diameters, or four randomly distributed broken wires in 30 rope diameters.
 - c. In pendants or standing wire ropes: More than two broken wires in one rope lay located in rope beyond end connections, and/or more than one broken wire in a rope.
 - A diameter reduction of more than 5 percent from nominal diameter.
 - Category III
 - In rotation-resistant wire rope, core protrusion or other distortion indicating core failure.
 - Electrical contact with a power line.
 - A broken strand
- Critical review items. The competent person will pay particular attention to:
 - Rotation-resistant wire rope in use.
 - Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.
 - Wire rope at flange points, crossover points, and repetitive pickup points on drums.
 - Wire rope adjacent to end connections.
 - Wire rope at, and on, equalizer sheaves.
- Removal from service
 - If a deficiency in Category I is identified, an immediate determination will be made by the competent person as to whether the deficiency constitutes a safety hazard. If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question will be prohibited until:
 - The wire rope is replaced; or

- If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two: the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.
- If a deficiency in Category II is identified, the manager (or his/her designee) will comply with Option A or Option B, as follows:
 - Option A. Consider the deficiency to constitute a safety hazard where it meets the wire rope manufacturer's established criterion for removal from service, or meets a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope. If the deficiency is considered a safety hazard, operations involving use of the wire rope in question will be prohibited until the wire rope is replaced; or
 - Option B. If the deficiency is localized, the problem is corrected by severing the wire rope in two: the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited.
- If a deficiency in Category III is identified, operations involving use of the wire rope in question will be prohibited until:
 - The wire rope is replaced; or
 - If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two: the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited.
- Where a wire rope is required to be removed from service under this section, either the equipment (as a whole) or the hoist with that wire rope will be tagged-out, in accordance with this procedure, until the wire rope is repaired or replaced

4.5.2 Monthly Wire Rope Inspection

- Each month a wire rope inspection will be conducted in accordance with the monthly crane inspection. Document the inspection using *S3AM-310-FM6 Wire Rope & Hook Inspection*, or equivalent.
- In addition, at least every 12 months, the wire ropes in use on equipment will be inspected by a qualified person for the types of deficiencies listed below.
 - The inspection will be complete and thorough, covering the surface of the entire length of the wire ropes, with particular attention given to:
 - Categories I, II, and III and critical review items.
 - Those sections that are normally hidden during shift and monthly inspections.
 - Wire rope in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited.
 - Wire rope subject to reverse bends.
 - Wire rope passing over sheaves.
 - Wire rope at or near terminal ends.
 - In the event a 12-month inspection is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed) or due to site conditions (such as a dense urban setting), such inspections will be conducted as soon as they becomes feasible, but no longer than an additional 6 months for running ropes; and for standing ropes, at the time of disassembly.

- If a deficiency is identified, an immediate determination will be made by the qualified person as to whether the deficiency constitutes a safety hazard.
 - If the deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question will be prohibited until:
 - The wire rope is replaced; or
 - If the deficiency is localized, the problem is corrected by severing the wire rope in two: the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited.
 - If the qualified person determines that, although not currently a safety hazard, the deficiency needs to be monitored, the manager (or his/her designee) shall confirm that the deficiency is checked in the monthly inspections.
 - The inspection shall be documented in accordance with this procedure.

4.5.3 Do not use rope lubricants that are of the type that hinder inspection.

4.6 Wire Rope – Selection and Installation Criteria

4.6.1 Select replacement wire rope in accordance with the requirements of this section, and the recommendations of the wire rope manufacturer, the equipment manufacturer, or a qualified person.

4.6.2 Boom-hoist reeving

- Do not use fiber core ropes for boom-hoist reeving, except for derricks.
- Use rotation-resistant ropes for boom-hoist reeving only where the requirements of 4.6.3 below are met.

4.6.3 Rotation-resistant ropes

- Definitions
 - Type I rotation-resistant rope is stranded rope constructed to have little or no tendency to rotate; or, if guided, transmits little or no torque. It has at least 15 outer strands and comprises an assembly of at least three layers of strands laid helically over a center in two operations. The direction of lay of the outer strands is opposite to that of the underlying layer.
 - Type II rotation-resistant rope is stranded rope constructed to have significant resistance to rotation. It has at least 10 outer strands and comprises an assembly of two or more layers of strands laid helically over a center in two or three operations. The direction of lay of the outer strands is opposite to that of the underlying lay.
- Requirements
 - Do not use Types II and III with an operating design factor of less than five for duty cycle or repetitive lifts.
 - Use rotation-resistant ropes (including Types I, II, and III) with an operating design factor of no less than 3.5.
 - Type I shall have an operating design factor of no less than five, except where the wire rope manufacturer and the equipment manufacturer approves the design factor, in writing.
 - Types II and III shall have an operating design factor of no less than five, except where the requirements of this section are met, as listed below.
- When Types II and III with an operating design factor of less than five are used (for non-duty cycle, non-repetitive lifts), the following requirements shall be met for each lifting operation:

- A qualified person shall inspect the rope in accordance with this procedure. The rope may be used only if the qualified person determines that there are no deficiencies constituting a hazard. In making this determination, more than one broken wire in any one rope lay will be considered a hazard.
 - Conduct operations in such a manner and at such speeds as to minimize dynamic effects.
 - Each lift made under these provisions will be recorded in the monthly and annual inspection documents. Such prior uses will be considered by the qualified person in determining whether to use the rope again.
 - Additional requirements
 - Do not use rotation-resistant ropes for boom-hoist reeving, except where the requirements of this section are met, as listed below.
 - Rotation-resistant ropes may be used as boom-hoist reeving when load hoists are used as boom hoists for attachments such as luffing attachments or boom and mast attachment systems. Under these conditions, the following requirements shall be met:
 - The drum shall provide a first-layer rope-pitch diameter of not less than 18 times the nominal diameter of the rope used.
 - The requirements in this standard (regardless of the date of manufacture of the equipment).
 - The requirements in ASME B30.5-2007, Section 5-1.3.2(a), (a)(2) through (a)(4), (b) and (d), except that the minimum pitch diameter for sheaves used in multiple-rope reeving is 18 times the nominal diameter of the rope used, instead of the value of 16 specified in Section 5-1.3.2(d).
 - All sheaves used in the boom-hoist reeving system shall have a rope-pitch diameter of not less than 18 times the nominal diameter of the rope used.
 - The operating design factor for the boom-hoist reeving system cannot be less than 5.
 - The operating design factor for these ropes will be the total minimum breaking force of all parts of rope in the system divided by the load imposed on the rope system when supporting the static weights of the structure, and the load within the equipment's rated capacity.
 - When provided, a power-controlled lowering system shall be capable of handling rated capacities and speeds as specified by the manufacturer.
- 4.6.4 Socketing will be done in the manner specified by the manufacturer of the wire rope or fitting.
- 4.6.5 Prior to cutting a wire rope, place seizings on each side of the point to be cut. The length and number of seizings will be in accordance with the wire-rope manufacturer's instructions.
- 4.7 Safety Devices
- 4.7.1 This section does not apply to side-boom cranes.
- 4.7.2 The following safety devices are required on all equipment covered by this procedure, unless otherwise specified:
- Crane-level indicator
 - The equipment will have a crane-level indicator that is either built into the equipment or is available on the equipment.
 - If a built-in crane-level indicator is not working properly, it will be tagged-out or removed.

- This requirement does not apply to portal cranes, derricks, floating cranes/derricks, and land cranes/derricks on barges, pontoons, vessels, or other means of flotation
- Boom stops, except for derricks and hydraulic booms.
- Jib stops (if jib is attached), except for derricks.
- Equipment with foot-pedal brakes will have locks, except for portal cranes and floating cranes.
- Hydraulic outrigger jacks will have an integral holding device/check valve.
- Equipment on rails will have rail clamps and rail stops, except for portal cranes.

4.7.3 Proper Operation Required

- Operations may not begin unless the devices listed in this section are in proper working order. If a device stops working properly during operations, the operator will safely stop operations. Do not resume operations until the device is working properly. Alternative measures are not permitted to be used.

4.8 Operational Aids for Mobile and Locomotive Cranes

4.8.1 This section does not apply to side-boom cranes.

4.8.2 Consult standards and regulations for the given jurisdiction for any applicable requirements concerning operational aids, including but not limited to:

- Two-blocking features
- Load indicators, rated capacity indicators, and rated capacity limiters
- Boom angle or radius indicator
- Boom-hoist disconnect, shut-off, or hydraulic relief
- Boom-length indicator
- Crane-level indicator
- Drum-rotation indicator.

4.9 Operational Aids for Tower Cranes

4.9.1 Do not begin operations unless the operational aids are in proper working order.

4.9.2 If an operational aid stops working properly during operations, the operator will safely stop operations until the device is again working properly.

4.9.3 Temporary alternative measures to a malfunctioning operational aid may be implemented with documented approval specific to the given crane and project by the manager and only if permitted by the regulatory jurisdiction. Temporary alternative measures that are approved must be in accordance with regulatory requirements and manufacturer specifications.

- Trolley-travel-limiting device. Restrict the travel of the trolley at both ends of the jib by a trolley-travel-limiting device to prevent the trolley from running into the trolley end-stops.
- Boom-hoist-limiting device. Limit the range of the boom at the minimum and maximum radius.
- Anti-two-blocking device. Equip the tower crane with a device that automatically prevents damage from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component). The device(s) shall prevent such damage at all points where two-blocking could occur.
- Hoist-drum-lower-limiting device. Equip tower cranes with a device that prevents the last two wraps of hoist cable from being spooled off the drum (consult jurisdictional requirements 5 wraps is not uncommon).

- Load-moment-limiting device. Provide the tower crane with a device that prevents moment overloading.
- Hoist-line pull-limiting device. Limit the capacity of the hoist to prevent overloading, including each individual gear ratio if equipped with a multiple-speed hoist transmission.
- Rail-travel-limiting device. Limit the travel distance in each direction to prevent the travel bogies from running into the end stops or buffers.
- Boom-hoist-drum positive locking device. Equip the boom-hoist drum with a device to positively lock the boom-hoist drum.
- Boom-angle or hook-radius indicator.
- Trolley-travel deceleration device. The trolley speed will be automatically reduced prior to the trolley reaching the end limit in both directions.
- Boom-hoist deceleration device. The boom speed will be automatically reduced prior to the boom reaching the minimum or maximum radius limit.
- Load-hoist deceleration device. The load speed will be automatically reduced prior to the hoist reaching the upper limit.
- Wind-speed indicator. Provide a device to display the wind speed, and mount above the upper rotating structure on tower cranes. On self-erecting cranes, mount at or above the jib level.
- Load-indicating device. A device that displays the magnitude of the load on the hook. Displays that are part of load-moment-limiting devices that display the load on the hook meet this requirement.

4.10 Crane Operator Qualifications

4.10.1 This section does not apply to side-boom cranes.

4.10.2 Operators of cranes shall hold a valid certification or license for the equipment operation (Crane and Hoist Equipment) issued by an accredited testing organization, a government licensing entity or an apprenticeship and accredited testing organization, as required by the appropriate jurisdictional regulatory body.

- Requirements for obtaining the applicable jurisdiction's license or certification shall include assessment, by written and practical tests, of the operator's ability and knowledge, including, but not limited to:
 - The controls and operational/performance characteristics.
 - Use of, and the ability to calculate (manually or with a calculator), load/capacity information on a variety of configurations of the equipment.
 - Procedures for preventing and responding to power line contact.
 - Technical knowledge applicable to the specific type of equipment the individual will operate.
 - Technical knowledge applicable to:
 - The suitability of the supporting ground and surface to handle expected loads.
 - Site hazards.
 - Site access.
 - Ability to recognize, from visual and audible observation, the items listed in shift inspection.
 - Operational and maneuvering skills.

- Application of load chart information.
 - Application of safe shut-down and securing procedures.
 - Licensing or certification shall be renewed as specified by the applicable jurisdiction and licensing/certifying body.
 - Appropriate legislation and apprenticeship boards shall be consulted to confirm compliance.
- 4.10.3 NOTE: If certification is not required and not available for a given jurisdiction for the equipment to be operated, verification of operator competency shall be documented (e.g. dependent upon jurisdiction: Boom Truck with lifting capacity less than 4.5 tonne (5 ton), Side Boom, etc.)
- 4.10.4 Apprentice operators/operators in training shall be registered, if applicable, with a recognized apprenticeship and accredited testing organization applicable to the jurisdiction in which the work is being conducted.
- Exemptions and subsequent requirements may apply.
 - Appropriate legislation, apprenticeship boards and or accredited testing organizations shall be consulted to confirm compliance.
 - Apprentice operators/operators in training shall work under the direct supervision of an authorized, competent certified crane operator. AECOM managers shall confirm the authorized worker performing direct supervision is competent, well trained in the operation of the particular lifting device, certified and capable of performing the required work.
 - For equipment other than tower cranes, the authorized worker performing direct supervision and the trainee/apprentice shall be in direct line of sight of each other, and will communicate verbally or by hand signals. For tower cranes, the authorized worker and the trainee/apprentice will be in direct communication with each other.
 - The trainee/apprentice shall be supervised by the operator's supervisor at all times, except for short breaks where the following are met:
 - The break lasts no longer than 15 minutes and there is no more than 1 break per hour.
 - Immediately prior to the break, the authorized worker performing direct supervision informs the trainee/apprentice of the specific tasks that the trainee/apprentice is to perform, and limitations that he/she is to adhere to during the authorized worker's break.
 - The specific tasks that the trainee/apprentice will perform during the authorized worker's break are within the trainee/apprentice's abilities.
 - The trainee/apprentice may not operate the equipment in any of the following circumstances:
 - If any part of the equipment, load line, or load (including rigging and lifting accessories), if operated up to the equipment's maximum working radius in the work zone, could get within the minimum approach distance of an overhead power line.
 - The equipment is used to hoist personnel.
 - The equipment is used over a shaft, cofferdam, or in a tank farm.
 - For multiple-lift rigging, except where the authorized worker performing direct supervision determines that the trainee's/apprentice's skills are sufficient for this high-skill work
 - All training of all apprentices or other uncertified operators shall be approved by the program or manager

- 4.10.5 For critical lifts, only crane operators certified to the appropriate jurisdictional standards and proven competent in the operation of the specific crane used in the lift may operate the crane.
- 4.10.6 **WARNING:** No apprentice operator/operator in training shall be permitted to operate any crane involved in a lift without sufficient prior training and direct, competent supervision appropriate to the equipment operated **UNLESS** jurisdictional standards permit otherwise.
- 4.10.7 The crane operator shall be qualified to use and be familiar with the hoisting equipment to be operated; otherwise sufficient time and instruction to adequately inspect and test the equipment shall be given.
- 4.10.8 The operator shall be able to perform and document, in a crane logbook, daily pre-operational maintenance checks to confirm the equipment can safely handle all loads. Crane operators shall have a general working knowledge of relevant safety codes and standards applicable to the operation of the given crane.
- 4.11 **Signal Person Qualification**
 - 4.11.1 The manager (or his/her designee) of the signal person shall confirm that each signal person meets the qualification requirements prior to giving any signals. This requirement will be met by using either of the following options:
 - Option 1 – Third-party–qualified evaluator: The signal person has documentation from a third-party qualified evaluator showing that the signal person meets the Qualification Requirements.
 - Option 2 – Manager’s (or his/her designee’s) qualified evaluator: The manager (or his/her designee) has his/her qualified evaluator assess the individual and determine that the individual meets the Qualification Requirements and provides documentation of that determination. An assessment by a manager’s (or his/her designee’s) qualified evaluator under this option is not portable – other managers (or their designees) are not permitted to use it to meet the requirements of this section.
 - The documentation for whichever option is used will be available while the signal person is employed by the manager (or his/her designee).
 - 4.11.2 If subsequent actions by the signal person indicate that the individual may not meet the Qualification Requirements, the manager (or his/her designee) shall not allow the individual to continue working as a signal person until retraining is provided and a reassessment is conducted, which confirms that the individual meets the Qualification Requirements.
 - 4.11.3 Qualification Requirements. Each signal person shall:
 - Know and understand the type of signals used. If hand signals are used, the signal person shall know and understand the Standard Method for hand signals. Refer to *S3AM-310-ATT2 Standard Hand Signals*.
 - Be competent in the application of the type of signals used.
 - Have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads, and boom deflection from hoisting loads.
 - Know and understand the relevant requirements of this procedure.
 - Demonstrate that he/she meets the requirements of this section through a verbal or written test and through a practical test.
 - Be familiar with working around Heavy equipment as outlined in *S3AM-309-PR1 Heavy Equipment*.
- 4.12 **Rigger Qualification**
 - 4.12.1 Personnel shall be trained in the selection of rigging, inspection, cautions to personnel, effects of the environment, and rigging practices.

- Refer to *S3AM-310-ATT3 Rigging*.

4.13 Maintenance and Repair Workers' Qualifications

Maintenance, inspection, and repair personnel are permitted to operate the equipment only if the following requirements are met:

- 4.13.1 The operation is limited to those functions necessary to perform maintenance, and to inspect or verify the performance of the equipment.
- 4.13.2 The personnel either:
 - Operate the equipment under the direct supervision of an operator who meets the requirements of Section 4.10 Crane Operator Qualifications of this procedure; or
 - Are familiar with the operation, safe limitations, characteristics, and hazards associated with the type of equipment.
- 4.13.3 Maintenance and repair personnel shall meet the definition of a qualified person with respect to the equipment and maintenance/repair tasks performed.

4.14 Overhead Power Line Safety

- 4.14.1 Before assembling or disassembling of a crane or operation of a crane, the manager (or his/her designee) shall determine if any part of the assembly / disassembly equipment, crane, load line, or load (including rigging and lifting accessories) could get closer than 50 feet (15.25 meters) to an power line during the assembly/disassembly process or during crane operation.
- 4.14.2 The manager (or his/her designee) shall assume that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.
 - The overhead power line owner/operator (e.g. local utility company) shall be contacted to determine the voltage of the overhead line and establish the appropriate minimum approach distance (MAD). Assembly/disassembly and crane operation inside the MAD is prohibited. Work or equipment operation closer than the MAD specified by regulation is only permitted when the following requirements are met:
 - The manager (or his/her designee) determines that it is infeasible to do the work without breaching the minimum approach distance as specified by regulatory requirements.
 - The manager (or his/her designee) determines that, after consultation with the utility owner/operator, it is infeasible to de-energize and ground the power line or relocate the power line.
 - The power line owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution determines the specific MAD that shall be maintained to prevent electrical contact in light of the on-site conditions. The factors that shall be considered in making this determination include, but are not limited to:
 - Conditions affecting atmospheric conductivity;
 - Time necessary to bring the equipment, load line, and load (including rigging and lifting accessories) to a complete stop;
 - Wind conditions;
 - Degree of sway in the power line;
 - Lighting conditions; and
 - Conditions affecting the ability to prevent electrical contact.

- A planning meeting with the manager (or his/her designee) and utility owner/operator (or a qualified person with respect to electrical power transmission and distribution) is held to determine the procedures that will be followed to prevent electrical contact and electrocution.
 - Procedures shall be documented, reviewed with affected personnel and be immediately available on-site.
 - No part of a crane/derrick, load line, or load (including rigging and lifting accessories), whether partially or fully assembled, is allowed within the MAD unless the manager (or his/her designee) has confirmed that the utility owner/operator has de-energized and visibly grounded the power line (at the worksite).
 - Work below an energized power line is permitted only if the manager confirms the uppermost part of the equipment (including those equipped with an extensible boom in the fully extended position at true vertical) could not encroach on the MAD.
- 4.14.3 Refer to *S3AM-322-PR1 Overhead Lines* for additional requirements.
- 4.14.4 The location of the power line(s), and the steps that will be implemented to prevent encroachment/electrocution (e.g. barricades, insulators, signal person, proximity alarms, warning lines, etc.) shall be included in the SH&E Plan and THA. This information shall be reviewed and communicated to affected personnel in the tailgate or specific pre-lift meeting.
- 4.14.5 There shall be at least one electrocution hazard warning conspicuously posted in the crane cab so that it is in view of the operator and tower(except for overhead gantry).
- 4.14.6 Use only non-conductive tag lines.
- 4.14.7 When working near transmitter/communication towers where the equipment is close enough for an electrical charge to be induced in the equipment or materials being handled, the transmitter will be de-energized, or the following precautions will be taken when necessary to dissipate induced voltages:
- Provide the equipment with an electrical ground.
 - Use non-conductive rigging or an insulating link/device.
- 4.14.8 Overhead Power Line Safety Training
- Train operators and crew assigned to work with the equipment on the following:
 - The procedures to be followed in the event of electrical contact with a power line, including:
 - Information regarding the danger of electrocution from the operator simultaneously touching the equipment and the ground.
 - The importance to the operator's safety of remaining inside the cab, except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
 - The safest means of evacuating from equipment that may be energized.
 - The danger for the potentially energized zone around the equipment.
 - The need for crew in the area to avoid approaching or touching the equipment.
 - Safe clearance distance from power lines.
 - Power lines are presumed to be energized unless the utility owner/operator confirms that the power line has been and continues to be de-energized and visibly grounded at the worksite.

- Power lines are presumed to be un-insulated unless the utility owner/operator or a registered engineer who is a qualified person with respect to electrical power transmission and distribution confirms that a line is insulated.
 - The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
 - Train persons working as dedicated spotters to enable them to effectively perform their task, including training on the applicable requirements of this section.
- 4.14.9 Devices originally designed by the manufacturer for use as:
- A safety device, operational aid, or a means to prevent power line contact or electrocution, when used to comply with this section, shall meet the manufacturer's procedures for use and conditions of use.
- 4.15 Equipment Modifications
- 4.15.1 Modifications or additions that affect the capacity or safe operation of the equipment are prohibited except where the requirements listed below apply.
- 4.15.2 Manufacturer's review and approval
- The manufacturer approves the modifications/additions in writing.
 - The load charts, procedures, instruction manuals, and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.
 - The original safety factor of the equipment is not reduced.
- 4.15.3 Unavailable manufacturer.
- If the manufacturer is unavailable, modifications or additions shall only be c the direction of a qualified person (e.g. professional engineer).
 - The load charts, procedures, instruction manuals, and instruction plates/tags/decals are modified at the direction of the qualified person and as necessary to accord with the modification/addition.
- 4.16 Assembly/Disassembly of Cranes
- 4.16.1 Supervision
- Assembly/disassembly shall be supervised by a person who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons (assembly / disassembly [A/D] supervisor). The A/D supervisor shall be experienced in working with the make and model of equipment being assembled or disassembled.
 - Where the assembly/disassembly is being performed by only one person, that person shall meet the criteria for both a competent person and a qualified person; an A / D supervisor.
- 4.16.2 Knowledge of procedures
- The A/D supervisor shall understand the applicable assembly/disassembly procedures.
- 4.16.3 Review of procedures
- The A/D supervisor shall review the applicable assembly/disassembly procedures, Pre-Job Hazard Assessment, Task Hazard Assessment (THA) for each task, or a written Assembly/Disassembly Procedure (Refer to *S3AM-310-FM12 Assembly - Disassembly Procedure*).
 - This review will be completed immediately prior to the commencement of assembly/disassembly, unless the A/D supervisor has applied them to the same type and

configuration of equipment (including accessories, if any) so that they are already known and understood.

4.16.4 Develop crew instructions for assembly/disassembly operation by using the minimum of a JSA for each task to be performed.

- Before commencing assembly/disassembly operations, during assembly/disassembly operations, before a crew member takes on a different task, or when adding new personnel during the operations the A/D supervisor shall determine that the crew members understand the following:
 - Their tasks;
 - The hazards associated with their tasks; and
 - The hazardous position/locations that they need to avoid.

4.16.5 Protecting assembly/disassembly crew members out of operator view

- Before a crew member goes to a location that is out of view of the operator and is either in, on, under, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member shall inform the operator that he/she is going to that location.
 - Where the crane operator knows that a crew member went to one of the above mentioned locations, the operator will not move any part of the equipment (or load) until the operator is informed in accordance with a pre-arranged system of communication that the crew member is in a safe position.

4.16.6 Working under the boom, jib, or other components

- When pins (or similar devices) are being removed, workers shall not be under the boom, jib, or other components, except where:
 - The manager (or his/her designee) demonstrates that site constraints require one or more workers to be under the boom, jib, or other components when pins (or similar devices) are being removed, the A/D supervisor shall implement procedures that minimize the risk of unintended dangerous movement, and minimize the duration and extent of exposure under the boom.

4.16.7 Capacity limits. During all phases of assembly/disassembly, rated capacity limits for loads imposed on the equipment, equipment components (including rigging), lifting lugs, and equipment accessories shall not be exceeded for the equipment being assembled/disassembled.

4.16.8 Addressing specific hazards. The A/D supervisor shall address the hazards associated with the operation with methods to protect the workers from them, as follows:

- Site and ground-bearing conditions. Site and ground conditions shall be adequate for safe assembly/disassembly operations and to support the equipment during assembly/disassembly.
- Blocking material. The size, amount, condition, and method of stacking blocking shall be sufficient to sustain the loads and maintain stability.
- Proper location of blocking. When used to support lattice booms or components, blocking shall be appropriately placed to:
 - Protect the structural integrity of the equipment; and
 - Prevent dangerous movement and collapse.
- Verifying assist crane loads. When using an assist crane, the loads that will be imposed on the assist crane at each phase of assembly/disassembly shall be verified before

assembly/disassembly begins, in order to prevent exceeding rated capacity limits for the assist crane.

- Boom and jib pick points. The point(s) of attachment of rigging to a boom (or boom sections, or jib or jib sections) shall be suitable for preventing structural damage and facilitating safe handling of these components.
- Center of gravity
 - Identify the center of gravity of the load if necessary for the method used for maintaining stability.
 - Where there is insufficient information to accurately identify the center of gravity, use measures designed to prevent unintended dangerous movement resulting from an inaccurate identification of the center of gravity.
- Stability upon pin removal. Rig or support the boom sections, boom suspension systems (such as gantry A-frames and jib struts), or components to maintain stability upon the removal of the pins.
- Snagging. Do not allow suspension ropes and pendants to catch on the boom or jib connection pins or cotter pins (including keepers and locking pins).
- Struck by counterweights. Prevent the potential for unexpected movement from inadequately supported counterweights and from hoisting counterweights.
- Boom-hoist brake failure. Where reliance is placed on the boom-hoist brake to prevent boom movement during assembly/disassembly, the brake will be tested to determine if it is sufficient to prevent boom movement. If it is not sufficient, a boom hoist pawl, other locking device/back-up braking device, or another method of preventing dangerous movement of the boom (such as blocking or using an assist crane) from a boom-hoist brake failure will be used.
- Loss of backward stability. Consider backward stability before swinging the upper works, travel, and the attaching or removing equipment components.
- Wind speed and weather. Consider wind speed and weather so that the safe assembly/disassembly of the equipment is not compromised.

4.16.9 Cantilevered boom sections. Do not exceed manufacturer's limitations on the maximum amount of boom supported only by cantilevering. When such limitations are not available, a registered professional engineer familiar with the type of equipment involved will determine this limitation in writing: this limit shall not be exceeded.

4.16.10 Weight of components. The weight of the components shall be readily available.

4.16.11 Components and configuration

- The selection of components and configuration of the equipment that affects the capacity or safe operation of the equipment shall be in accordance with:
 - Manufacturer's instructions, limitations, and specifications. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved shall approve, in writing, the selection and configuration of components; or
 - Approved modifications that meet the equipment requirements.
- Post-assembly inspection. Upon completion of assembly, inspect the equipment to confirm compliance with the AECOM initial and annual crane inspection and load testing.

4.16.12 Manufacturer's prohibitions. The manager (or his/her designee) shall comply with applicable manufacturer's prohibitions.

- 4.16.13 Shipping pins. Remove reusable shipping pins, straps, links, and similar equipment, and store so that they do not present a falling-object hazard.
- 4.16.14 Pile driving. Equipment used for pile driving shall not have a jib attached during pile-driving operations.
- 4.16.15 Outriggers. When the load to be handled and the operating radius require the use of outriggers, or at any time when outriggers are used, the following requirements shall be met:
- The outriggers shall be either fully extended; or, if the manufacturer's procedures permit, deployed as specified in the load chart.
 - The outrigger shall be set with the machine-supported level, on fully extended outriggers with all tires free of the supporting surface (clear of the surface), except for locomotive cranes (see paragraph 15.f of this section for use of outriggers on locomotive cranes).
 - When outrigger floats are used, they shall be attached to the outriggers.
 - Each outrigger shall be visible to the operator or to a signal person during extension and setting.
 - Outrigger blocking shall:
 - Meet the requirements in paragraphs 8.b and 8.c of this section.
 - Be placed only under the outrigger float, and/or the outrigger jack. Where the outrigger is designed without a jack, the blocking shall be placed under the outer bearing surface of the extended outrigger beam.
 - For locomotive cranes, when using outriggers to handle loads, the manufacturer's procedures shall be followed. When lifting loads without using outriggers, the manufacturer's procedures will be met regarding truck wedges or screws.
- 4.16.16 Assembly/Disassembly – Additional Requirements for Booms and Jibs
- Do not remove any of the pins in the pendants (partly or completely) when the pendants are in tension.
 - Do not remove any of the pins (top and bottom) on boom sections located between the uppermost boom section and the crane/derrick body (partly or completely) when the boom is being supported by the uppermost boom section resting on the ground (or other support).
 - Do not remove any of the top pins on boom sections located on the cantilevered portion of the boom being removed (the portion being removed ahead of the pendant attachment points) (partly or completely) until the cantilevered section to be removed is fully supported.
- 4.16.17 Assembly/Disassembly – Manager Procedures
- When using the manager's (or his/her designee's) procedures instead of the manufacturer's procedures for assembling or disassembling, the manager (or his/her designee) shall confirm that the procedures are designed to:
 - Prevent unintended dangerous movement, and prevent collapse of all parts of the equipment.
 - Provide adequate support and stability of all parts of the equipment during the assembly/disassembly process.
 - Position workers involved in the assembly/disassembly operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized.
 - Manager's procedures shall be developed by a qualified person.

4.17 Operation

- 4.17.1 The manager (or his/her designee) will comply with all the manufacturer's procedures applicable to the operational functions of equipment, including its use with attachments. The manager (or his/her designee) should consider the use of equipment that has all the manufacturer's procedures and information available during the planning stages of the project.
- 4.17.2 Unavailable Operation Procedures
- Where the manufacturer's procedures are unavailable, the manager (or his/her designee) will develop and confirm compliance with all procedures necessary for the safe operation of the equipment and attachments.
 - Procedures for the operational controls shall be developed by a qualified person.
 - Procedures related to the capacity of the equipment shall be developed and signed by a registered professional engineer familiar with the equipment.
- 4.17.3 Operational procedures
- All cranes arriving on site require pre-inspection, initial and annual inspections, load test, and verification of operator qualifications.
 - Prior to operation of crane on site, conduct pre-lift planning in accordance with *S3AM-310-FM2 Lift Classification* or assembly/disassembly procedures. Refer to *S3AM-310-FM12 Assembly – Disassembly Procedure*.
 - Equipment set-up.
 - Confirm the equipment will be uniformly level, within 1 percent of level grade, and located on footing that a qualified person has determined to be sufficiently firm and stable.
 - Equipment with outriggers shall have all outriggers extended and locked. The amount of extension shall be the same for all outriggers, and in accordance with the manufacturer's procedures and load charts.
 - Procedures related to the capacity of the equipment shall be developed and signed by a registered professional engineer familiar with the equipment.
- 4.17.4 Accessibility of procedures
- The procedures applicable to the operation of the equipment, including rated capacities (load charts), recommended operating speeds, special hazard warnings, instructions, and operator's manual, shall be readily available in the cab at all times for use by the operator.
 - Where rated capacities are available in the cab only in electronic form: in the event of a failure that makes the rated capacities inaccessible, the operator shall immediately cease operations or follow safe shut-down procedures until the rated capacities are available.
- 4.17.5 The operator shall not engage in any practice that diverts his/her attention while actually engaged in operating the crane, such as the use of cell phones (other than when used for signal communications) or other attention-diverting activities.
- 4.17.6 Leaving the equipment unattended
- The operator shall not leave the controls while the load is suspended, except where permitted by the applicable jurisdiction and the following are met:
 - The operator remains adjacent to the equipment and is not engaged in any other duties.
 - The load is to be held suspended for a period of time exceeding normal lifting operations.
 - The competent person determines that it is safe to do so, and implements measures necessary to restrain the boom hoist and telescoping, load, swing, and outrigger functions.
 - Barricades or caution lines (and notices) are erected to prevent all workers from entering

the fall zone. Do not permit workers in the fall zone.

- The provisions of this section do not apply to working gear (such as slings, spreader bars, ladders, and welding machines) where the load is not suspended over an entrance or exit.

4.17.7 Tag-Out

- Where the manager (or his/her designee) has taken the equipment out of service, a tag shall be placed in the cab stating that the equipment is out of service and is not to be used. Where the manager (or his/her designee) has taken a function(s) out of service, a tag shall be placed in a conspicuous position stating that the function is out of service and is not to be used.
- Response to “Do Not Operate” tag-out signs
 - If there is a warning (tag-out or maintenance/do not operate) sign on the equipment or starting control, the operator shall not activate the switch or start the equipment until the sign has been removed by a management person authorized to remove it.
 - An inspection of the entire area shall be completed, and all attempts shall be made to locate the person who applied the tag or lock prior to any actions. If the person who applied the tag or lock cannot be located, the following steps shall be adhered to. Management shall determine that:
 - No one is servicing, working on, or otherwise in a dangerous position on the machine.
 - The equipment has been repaired and is working properly.

4.17.8 Before starting the engine, the operator shall verify that all controls are in the proper starting position and that all personnel are in the clear.

4.17.9 When a local storm warning has been issued, the competent person will determine whether it is necessary to implement manufacturer’s recommendations for securing the equipment.

4.17.10 The operator shall be familiar with the equipment and its proper operation. If adjustments or repairs are necessary, the operator shall promptly inform the person designated by the manager to receive such information; and, where there are successive shifts, inform the next operator.

4.17.11 In all cases verified weights, measured radii, and manufacturer’s loads and capacity chart/capacities and instructions will take precedence over operational aids when handling a load.

4.17.12 If the competent person determines that there is a slack rope condition requiring re-spooling of the rope, it will be verified (before starting to lift) that the rope is seated on the drum and in the sheaves as the slack is removed.

4.17.13 The competent person will consider the effect of wind, ice, and snow on equipment stability and rated capacity. Crane Manufacturers Operators Manual should be referenced to determine the wind speed and temperature restrictions that apply to each specific crane.

4.17.14 Compliance with rated capacity

- Do not operate the equipment in excess of its rated capacity.
- The operator will verify that the load is within the rated capacity of the equipment by at least one of the following methods:
 - The weight of the load will be determined from a reliable source (such as the load’s manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per-foot weight), or by other equally reliable means. In addition, when requested by the operator, this information will be provided to the operator prior to the lift; or
 - The operator will begin hoisting the load to determine—using a load-weighing device—load-moment indicator, rated-capacity indicator, or rated-capacity limiter, if it exceeds 75

percent of the maximum rated capacity at the longest radius that will be used during the lift operation. If it does, the operator will not proceed with the lift until management verifies the weight of the load.

- 4.17.15 The boom or other parts of the equipment shall not contact any obstruction.
- 4.17.16 Do not use the equipment to drag or pull loads sideways.
- 4.17.17 On wheel-mounted equipment, do not lift loads over the front area, except as permitted by the manufacturer.
- 4.17.18 The operator will test the brakes each time a load that is 90 percent or more of the maximum line pull is handled by lifting the load a few inches and applying the brakes. In duty cycle and repetitive lifts where each lift is 90 percent or more of the maximum line pull, this requirement applies to the first lift, but not to successive lifts.
- 4.17.19 Do not lower the load or the boom below the point where less than two full wraps of rope remain on their respective drums.
- 4.17.20 Traveling with a load.
 - Traveling with a load is prohibited if the practice is prohibited by the manufacturer.
 - Where traveling with a load, the manager (or his/her designee) will confirm that:
 - A competent person supervises the operation, determines if it is necessary to reduce rated capacity, and makes determinations regarding load position, boom location, ground support, travel route, overhead obstructions, and speed of movement necessary to confirm safety.
 - The determinations of the competent person are implemented.
 - For equipment with tires, maintain tire pressure specified by the manufacturer.
- 4.17.21 Rotational speed of the equipment shall be such that the load does not swing out beyond the radius at which it can be controlled.
- 4.17.22 A tag or restraint line shall be used if necessary to prevent rotation of the load that would be hazardous.
- 4.17.23 Adjust the brakes in accordance with the manufacturer's procedures to prevent unintended movement.
- 4.17.24 The operator shall obey a stop (or emergency stop) signal, irrespective of who gives it.
- 4.17.25 A locomotive crane shall not be swung into a position where it is reasonably foreseeable that railway cars on an adjacent track could strike it, until it is determined that cars are not being moved on the adjacent track, and that proper flag protection has been established.
- 4.17.26 Counterweight/Ballast
 - The following applies to equipment other than tower cranes:
 - Do not operate equipment without the counterweight or ballast in place, as specified by the manufacturer.
 - Do not exceed the maximum counterweight or ballast specified by the manufacturer for the equipment.
- 4.17.27 Authority to Stop Operation
 - Whenever there is a safety concern, the operator or any other workers associated with the operation have the authority to stop, and refuse to handle loads until a qualified person has determined that safety has been assured. Refer to *S3AM-002-PR1 Stop Work Authority*.

4.18 Swing Radius Hazards

- 4.18.1 The requirements in paragraph 2 of this section apply where there are accessible areas in which the equipment's rotating superstructure (whether permanently or temporarily mounted) poses a reasonably foreseeable risk of:
- Striking and injuring a worker; or
 - Pinching/crushing a worker against another part of the equipment or another object.
- 4.18.2 To prevent workers from entering these hazard areas, the manager (or his/her designee) shall:
- Instruct workers assigned to work on or near the equipment (authorized personnel) in how to recognize struck-by and pinch/crush hazards areas posed by the rotating superstructure.
 - Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas. Exception: where it is neither feasible to erect such barriers on the ground nor on the equipment, the hazards areas shall be clearly marked by a combination of warning signs and high-visibility markings on the equipment that identify the hazard areas. In addition, the manager (or his/her designee) shall train the workers to understand what these markings signify.
- 4.18.3 Protecting Workers in the Hazard Area
- Before a worker goes to a location in the hazard area out of view of the operator, the worker (or someone instructed by the worker) shall confirm the operator is informed of the area out of the view where the worker will be present.
 - Where the operator knows that a worker went to a location out of his/her view, the operator will not rotate the superstructure until the operator:
 - Is informed in accordance with a pre-arranged system of communication that the worker is in a safe position.
- 4.18.4 Multiple Equipment Coordination. Where any part of a crane/derrick is within the working radius of another crane/derrick, the controlling entity shall institute a system to coordinate operations. If there is no controlling entity, the manager (or his/her designee) shall institute such a system.
- 4.18.5 Keeping Clear of the Load
- Where available, hoisting routes that minimize the exposure of workers to hoisted loads will be used, to the extent consistent with public safety.
 - Although the operator is not moving a suspended load, no worker will be within the fall zone, except for workers:
 - Engaged in hooking, unhooking, or guiding a load;
 - Engaged in the initial attachment of the load to a component or structure; or
 - Operating a concrete hopper or concrete bucket.
- 4.18.6 When workers are engaged in hooking, unhooking, or guiding the load, or in the initial connection of a load to a component or structure and are within the fall zone, the following criteria shall be met:
- Rig the materials being hoisted to prevent unintentional displacement.
 - Use hooks with self-closing latches or their equivalent. Exception: "J" hooks are permitted to be used for setting wooden trusses.
 - Confirm the materials are rigged by a qualified rigger. Refer to *S3AM-310-ATT3 Rigging*.
- 4.18.7 Receiving a load. Only workers needed to receive a load will be permitted to be within the fall zone when a load is being landed.

4.18.8 During a tilt-up or tilt-down operation:

- No worker will be directly under the load.
- Only workers essential to the operation will be in the fall zone (but not directly under the load).
Note: Boom free-fall is prohibited when a worker is in the fall zone of the boom or load.

4.19 Free-fall and Controlled-Load Lowering

4.19.1 This section does not apply to side-boom cranes in which the boom is designed to free-fall (live boom) that are manufactured prior to January 2009.

4.19.2 Boom and load free-fall prohibitions

- The use of equipment in which the boom is designed to free-fall (live boom) is prohibited in each of the following circumstances:
 - A worker is in the fall zone of the boom or load.
 - A worker is being hoisted.
 - The load or boom is directly over a power line, or over any part of the MAD to each side of the power line.
 - The load is over a shaft.
 - The load is over a cofferdam, except where there are no workers in the fall zone.
 - Lifting operations are taking place in a refinery or tank farm.
- The use of equipment in which the boom is designed to free-fall (live boom) is permitted only where none of the circumstances listed above are present and:
 - The equipment was manufactured prior to October 31, 1984; or
 - The equipment is a floating crane/derrick or a land crane/derrick on a vessel/flotation device.

4.19.3 Preventing boom free-fall. Where the use of equipment with a boom that is designed to free-fall (live boom) is prohibited, the boom hoist shall have a secondary mechanism or device designed to prevent the boom from falling in the event the primary system used to hold or regulate the boom hoist fails, as follows:

- Friction drums; these shall have:
 - A friction clutch and a braking device to allow for controlled boom lowering.
 - A secondary braking or locking device, which is manually or automatically engaged, to back up the primary brake while the boom is held (such as a secondary friction brake or a ratchet and pawl device).
- Hydraulic drums shall have an integrally mounted holding device or internal static brake to prevent boom hoist movement in the event of hydraulic failure.
- Neither clutches nor hydraulic motors will be considered brake or locking devices for purposes of this subpart.
- Hydraulic boom cylinders shall have an integrally mounted holding device.

4.19.4 Preventing uncontrolled retraction. Hydraulic telescoping booms shall have an integrally mounted holding device to prevent the boom from retracting in the event of hydraulic failure.

4.20 Signals – General Requirements

4.20.1 A signal person shall be provided in each of the following situations:

- The point of operation, meaning the load travel or the area near or at load placement, is not in full view of the operator.
- When the equipment is traveling, the view in the direction of travel is obstructed.
- Due to site-specific safety concerns, either the operator or the person handling the load determines that it is necessary.

4.20.2 Types of signals. Signals to operators shall be by hand, voice or audible.

- Signals other than hand, voice, or audible signals may be used where the manager (or his/her designee) demonstrates that:
 - The new signals provide communication at least equally effective as voice, audible, or standard method hand signals; or
 - There is a national consensus standard for the new signals.
- The signals used (hand, voice, audible, or new), and means of transmitting the signals to the operator (such as direct line of sight, video, radio, etc.), shall be appropriate for the site conditions.
- During operations requiring signals, the ability to transmit signals between the operator and signal person shall be maintained. If that ability is interrupted at any time, the operator will safely stop operations requiring signals until it is reestablished, and a proper signal is given and understood.
- If the operator becomes aware of a safety problem and needs to communicate with the signal person, the operator shall safely stop operations. Operations may not resume until the operator and signal person agree that the problem has been resolved.
- Only one person gives signals to a crane/derrick at a time, however anyone who becomes aware of a safety problem shall alert the operator or signal person by giving the stop or emergency stop signal. Note that this procedure requires the operator to obey any stop or emergency stop signal.
- All directions given to the operator by the signal person shall be given from the operator's direction perspective.
- Communication with multiple cranes/derricks. Where a signal person(s) is in communication with more than one crane/derrick, a system for identifying which crane/derrick each signal is for shall be used, as follows:
 - For each signal, prior to giving the function/direction, the signal person will identify the crane/derrick the signal is for; or
 - An equally effective method of identifying which crane/derrick the signal is for shall be used.
- Signals – Radio, Telephone, or other Electronic Transmission
 - Test the device(s) used to transmit signals on site before beginning operations to confirm that the signal transmission is clear and reliable.
 - Signal transmission shall be through a dedicated channel. Exception: Multiple cranes/derricks and one or more signal persons may share a dedicated channel for the purpose of coordinating operations.
 - The operator's reception of signals shall be by a hands-free system.
- Signals – Voice
 - Prior to beginning operations, the operator, signal person, and lift supervisor (if there is one), will contact each other and agree on the voice signals that will be used. Once the

voice signals are agreed upon, these workers need not meet again to discuss voice signals unless another worker is substituted; there is confusion about the voice signals; or a voice signal is to be changed.

- Each voice signal shall contain the following three elements, given in the following order: function (such as hoist, boom, etc.), direction (distance and/or speed); and the 'stop' command.
- The operator, signal person, and lift supervisor (if there is one), shall be able to effectively communicate in the language used.
- Signals – Hand Signal Chart
 - Hand signal charts shall either be posted on the equipment or readily available at the site. Refer to *S3AM-310-ATT2 Standard Hand Signals*.
 - Both the operator and the signaler shall be conversant in the standard hand signals.
 - Operators shall only take slow, smooth and decisive signals from a qualified, designated and identifiable signaler.
 - The operator shall obey an emergency stop signal given by any personnel.

4.21 Training

The manager (or his/her designee) shall provide training in accordance with regulatory requirements, certification / licensing requirements and *S3AM-003-PR1 SH&E Training*. As applicable, training may include, but is not limited to:

4.21.1 Overhead power lines.

4.21.2 Signal persons.

4.21.3 Equipment operation.

- Train operators who are not qualified or certified under the conditions within this standard in those areas addressed in this standard. Provide retraining if necessary for re-qualification or re-certification or if the operator does not pass a qualification or certification test.
- Train operators in the following practices:
 - On friction equipment, whenever moving a boom off a support, first raise the boom a short distance (sufficient to take the load off the boom) to determine if the boom hoist brake needs to be adjusted. On other types of equipment, the same practice is applicable, except that typically there is no means of adjusting the brake; if the brake does not hold, a repair is necessary.
 - Where available, the manufacturer's emergency procedures for halting unintended equipment movement.

4.21.4 Competent persons and qualified persons. Train competent persons and qualified persons regarding the requirements of standards and regulations applicable to their respective roles. Refer to *S3AM-202-PR1 Competent Person Designation*.

4.21.5 Crush/pinch points. Instruct workers who work with the equipment to keep clear of holes, and crush/pinch points and the hazards addressed in this procedure (work area control).

4.21.6 Fall Protection

4.21.7 Lock-out /Tag-out. Train operators and other workers authorized to start/energize equipment or operate equipment controls (such as maintenance and repair workers) in the tag-out measures in this procedure.

4.21.8 Training administration

- The manager (or his/her designee) shall confirm that workers required to be trained under this procedure are evaluated to confirm that they understand the information provided in the training.
- Provide refresher training in relevant topics when, based on the conduct of the worker or an evaluation of the worker's knowledge, there is an indication that retraining is necessary

4.22 Critical Lifts

4.22.1 Critical lift identifies loads classified as requiring a formal, written plan.

4.22.2 A critical lift plan shall be developed by an appropriately competent and qualified person or persons and requires review and approval by the involved individuals (e.g. rigging supervisor, crane operator, AECOM manager, etc.).

4.22.3 Critical Lift Plan Requirements

- A Critical Lift Plan consists of as many drawings, specifications, and procedures as necessary to accurately assess all important load factors and site factors relating to a Critical Lift. These items are included as a guide, but should not be interpreted as being all-inclusive in the analysis and preparation of a Critical or Pre-Engineered Lift. Sound engineering and planning is still the responsibility of the engineer and/or project supervisor associated with the lift. *S3AM-310-ATT5 Checklist for Lift Planning* summarizes those factors and may be used to review completeness of a lift plan. Most lifts do not involve all of the factors listed in the checklist.
- The following is the minimum level of information required for completing an adequate critical lift plan:
 - Elevation View Drawing of the crane, load, and any nearby structures that could cause interference. This drawing shall be made to scale and should note:
 - Crane manufacturer(s), model(s), and counterweight(s), if variable.
 - Boom length(s) and lifting radius.
 - Maximum load elevation during lifting procedure.
 - Any jibs or special lifting devices required.
 - Minimum number of parts of crane hoist line required for lifting the load.
 - All required slings, shackles, and other rigging components identified by capacity, size, length, and location.
 - Calculated center of gravity of load.
 - Plan View Drawing of the crane, load, and nearby structures that could cause interference. This drawing shall be made to scale and should note:
 - Route that transport will take to position the load for lifting.
 - Initial lifting position of the load, including radius. Lifting radius shall be accurately determined.
 - Final placement position of the load, including radius. Lifting radius shall be accurately determined.
 - Location of the crane(s), including tail swing limits.
 - Route that crane(s) will take if walking with the load, as well as associated matting requirements.
 - Any utilities located within the work zone. Underground facilities—piping, ducts, etc.—shall be accurately located.

- Space may be needed to assemble crane.
- Planning shall include load transportation considerations, such as how to get the load close enough to the crane. This may be a function of the type of crane being used, because some cranes perform better in certain sectors (quadrants) of operation than others.
- Lift Analysis, including:
 - Tabulation of the gross load weight, including the weight of all blocks and rigging tackle.
 - Rigging attachment points and special rigging requirements.
 - Gross rated capacity of the crane in the configuration specified.
 - Calculation of the percentage of the crane's rated capacity at which the lift will be made.
 - Crane-imposed soil loads shall be determined. Soil analysis may be needed to verify crane-imposed loads can be safely supported.
 - Allowable weather conditions for the lift, and the effect of wind loading.
 - Sequence of work, including lift-off, steady-state conditions, and set-down of load (including positions where there is a shift in the location of the center of gravity, for the pick points).
 - Copy of the completed *S3AM-310-FM3 Critical Lift Plan*.
 - Copy of crane range diagram.
 - Copy of crane load chart.
 - Rigging diagram indicating minimum size of slings and shackles.
 - Calculation indicating adequacy of rigging.
 - Copy of crane outline dimensions.
- All potential complicating issues for any lift shall be addressed in the lift plan; however, for a relatively simple operation, the above items can provide sufficient information, and may even be organized onto one drawing.

4.23 Personnel Hoisting

- 4.23.1 Hoisting personnel is considered to be a Critical Lift. The requirements of this section are supplemental to the other requirements in this procedure, and apply when one or more workers are hoisted.
- 4.23.2 All of the following criteria shall be observed and in place prior to any personnel hoisting. Complete *S3AM-310-FM11 Personnel Platform Lifting* along with applicable signatures prior to lifting, as well as any criteria required in the Critical Lifts section of this standard.
- 4.23.3 Hoisting of personnel shall only be permitted when AECOM can show that the erection, use, and dismantling of conventional means of reaching the worksite, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions.
- 4.23.4 Hoisting of personnel is always prohibited (even if hoisting personnel is otherwise permitted), when:
 - Any part of the equipment would encroach on the MAD of a power line.
 - Equipment is traveling unless the equipment travels on fixed rails or the employer can demonstrate that there is no less hazardous way to perform the work. However, when the

equipment is a derrick, it may not be used to hoist personnel while traveling under any circumstances.

- The equipment has a rated hoisting/lifting capacity of 2,000 pounds (907 kilograms) or less.

4.23.5 Exceptions: If the use of a personnel platform is not feasible:

- When transferring a worker into and out of drill shafts that are up to and including 8 feet (2.4 meters) in diameter, the worker may be hoisted in a boatswain's chair.
- In pile driving operations, the worker may be hoisted in a boatswain's chair.
- In storage tank (steel or concrete), shaft, and chimney operations, the worker may be hoisted in a boatswain's chair.
- Solely for transfer to or from a marine worksite, the worker may be transported in a marine hoisted-personnel transfer device.
- In addition to the same crane setup and operational requirements for personnel platforms, the following apply to hoisting workers using a boatswain's chair:
 - The boatswain's chair itself (excluding the personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.
 - No more than one person will be hoisted at a time.
 - For lattice-boom cranes, the cable shall be clearly marked, so that it can easily be seen by the operator, at a point that will give the operator sufficient time to stop the hoist to prevent two-blocking, and use a spotter. If using a boatswain's chair:
 - Worker shall be hoisted in a slow, controlled descent and ascent.
 - The worker shall use personal fall protection equipment, including a full body harness, independently attached to the lower load block or overhaul ball. Refer to *S3AM-304-PR1 Fall Protection*.
 - Station a signal person at shaft openings.
- In addition to the same crane setup and operational requirements for personnel platforms, the following apply to hoisting workers using.
 - The transfer device will be used only for transferring workers.
 - The number of workers occupying the transfer device will not exceed the maximum number it was designed to hold.
 - Each worker shall wear a personal flotation device approved to the appropriate standard for industrial use.

4.23.6 Equipment set-up

- The equipment shall be uniformly level, within 1 percent of level grade, and located on footing that a qualified person has determined to be sufficiently firm and stable.
- Equipment with outriggers shall have them all extended and locked. The amount of extension shall be the same for all outriggers and in accordance with the manufacturer's procedures and load charts.

4.23.7 Equipment criteria

- Capacity – Use of suspended personnel platforms. The total load (with the platform loaded, including the hook, load line, and rigging) will not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.

- Capacity – Use of boom-attached personnel platforms. The total weight of the loaded personnel platform will not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
- Capacity – Hoisting personnel without a personnel platform. When hoisting personnel without a personnel platform, the total load (including the hook, load line, rigging and any other equipment that imposes a load) will not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
- When the occupied personnel platform is in a stationary working position, the load and boom hoist brakes, swing brakes, and operator-actuated secondary braking and locking features (such as pawls or dogs) or automatic secondary brakes shall be engaged.
- Devices.
 - Equipment (except for derricks) with a variable-angle boom shall be equipped with:
 - A boom angle indicator, readily visible to the operator.
 - A boom hoist limiting device.
 - Equipment with a luffing jib shall be equipped with:
 - A jib angle indicator, readily visible to the operator.
 - A jib hoist limiting device.
 - Equipment with telescoping booms shall be equipped with a device to indicate the boom's extended length clearly to the operator, or have measuring marks on the boom.
 - Anti-two-block. A device that automatically prevents damage and load failure from contact between the load block, overhaul ball, or similar component, and the boom tip (or fixed upper block or similar component) shall be used. The device(s) shall prevent such damage/failure at all points where two-blocking could occur.
 - Controlled load lowering. The load line hoist drum shall have a system, other than the load line hoist brake, that regulates the lowering rate of speed of the hoist mechanism. This system or device shall be used when hoisting personnel. Free-fall of the load line hoist is prohibited. The use of equipment in which the boom hoist mechanism can free-fall is prohibited.
 - Proper operation required. Personnel hoisting operations will not begin unless the devices listed in this section are in proper working order. If a device stops working properly during such operations, the operator shall safely stop operation. Personnel hoisting operations shall not resume until the device is again working properly. Alternative measures are not permitted.
- Direct attachment of a personnel platform to a luffing jib is prohibited.

4.23.8 Personnel platform criteria

- The personnel platform and attachment/suspension system shall be designed for hoisting personnel by a qualified person familiar with structural design.
- The system used to connect the personnel platform to the equipment shall allow the platform to remain within 10 degrees of level, regardless of boom angle.
- The suspension system shall be designed to minimize tipping of the platform due to movement of workers occupying the platform.
- The personnel platform itself (excluding the guardrail system and personal fall arrest system anchorages), shall be capable of supporting, without failure, its own weight and at least five times the maximum intended load.

- All welding of the personnel platform and its components shall be performed by a certified welder familiar with the weld grades, types, and material specified in the platform design, and inspected and certified by a qualified person (e.g. professional engineer).
- Equip the personnel platform with a guardrail system that meets the requirements of *S3AM-304-PR1 Fall Protection*, and is enclosed at least from the toe-board to mid-rail with either solid construction material, or expanded metal having openings no greater than ½ inch (1.27 centimeters). Points to which personal fall arrest systems are attached shall meet the anchorage requirements as outlined in *S3AM-304-PR1 Fall Protection*.
- Install a grab rail inside the entire perimeter of the personnel platform except for access gates/doors.
- Access gates/doors. If installed, access gates/doors of all types (including swinging, sliding, folding, or other types) will:
 - Not swing outward.
 - Be equipped with a device that prevents accidental opening.
- Confirm headroom is sufficient to allow workers to stand upright in the platform.
- In addition to the use of hard hats, protect workers by overhead protection on the personnel platform when workers are exposed to falling objects.
- All edges exposed to worker contact shall be smooth enough to prevent injury.
- Conspicuously post the weight of the platform and its rated capacity on the platform with a plate or other permanent marking.

4.23.9 Attachment and rigging

- Dedicated rigging: Do not use the rigging used for hoisting personnel for any other hoisting activities such as materials or equipment.
- Rigging hardware (including wire rope, shackles, rings, master links, and other rigging hardware) and hooks shall be capable of supporting, without failure, at least ten times the maximum intended load applied or transmitted to that component.
- Hooks and other detachable devices.
 - Hooks used in the connection between the hoist line and the personnel platform (including hooks on overhaul ball assemblies, lower load blocks, bridle legs, or other attachment assemblies or components) shall be:
 - Of a type that can be closed and locked, eliminating the throat opening.
 - Closed and locked when attached.
 - Shackles used in place of hooks shall be of the alloy anchor type, with either:
 - A bolt, nut, and retaining pin designed for the shackle, in place; or
 - Of the screw type, with the screw pin secured from accidental removal.
 - Where other detachable devices are used, they shall be of the type that can be closed and locked. Such devices shall be closed and locked when attached.
- Rope bridle. When a rope bridle is used to suspend the personnel platform, each bridle leg shall be connected to a master link or shackle in a manner that confirms that the load is evenly divided among the bridle legs.
- Fabricate eyes in wire rope slings with thimbles.
- Use bridles and associated rigging for suspending the personnel platform only for the platform

and the necessary workers, their tools, and materials necessary to do their work, and do not use for any other purpose when not hoisting personnel.

4.23.10 Trial lift and inspection

- Make a trial lift with the unoccupied personnel platform loaded at least to the anticipated lift weight from ground level, or any other location where workers will enter the platform, to each location at which the platform is to be hoisted and positioned. Where there is more than one location to be reached from a single set-up position, perform either individual trial lifts for each location, or a single trial lift for all locations.
- Perform the trial lift immediately prior to each shift in which personnel will be hoisted. In addition, repeat the trial lift prior to hoisting workers in each of the following circumstances:
 - The equipment is moved and set up in a new location or returned to a previously used location.
 - The lift route is changed, unless the competent person determines that the new route presents no new factors affecting safety.
- The competent person shall determine that:
 - Safety devices and operational aids required by this section are activated and functioning properly.
 - Nothing interferes with the crane or the personnel platform in the course of the trial lift.
 - The lift will not exceed 50 percent of the crane's rated capacity at any time during the lift.
 - The load radius to be used during the lift has been accurately determined.
- Immediately after the trial lift, the competent person shall:
 - Conduct a visual inspection of the equipment, base support or ground, and personnel platform to determine whether the trial lift has exposed any adverse effect.
 - Confirm the test weight has been removed upon the completion of the trial lift.
- Immediately prior to each lift:
 - Hoist the platform a few inches and have it inspected by a competent person to confirm that it is secure and properly balanced.
 - The following conditions shall be determined to exist by a competent person before the lift of personnel proceeds:
 - Hoist ropes are free of deficiencies in accordance with this procedure.
 - Multiple part lines are not twisted around each other.
 - The primary attachment is centered over the platform.
 - If the load rope is slack, the hoisting system shall be inspected to confirm that all ropes are properly seated on drums and in sheaves.
- Any condition found during the trial lift and subsequent inspection(s) that fails to meet a requirement of this procedure or otherwise creates a safety hazard shall be corrected before hoisting personnel.

4.23.11 Proof testing

- At each jobsite, prior to hoisting workers on the personnel platform, and after any repair or modification, the platform and rigging shall be proof-tested to 125 percent of the platform's rated capacity. The proof test may be done concurrently with the trial lift.
- The platform shall be lowered by controlled load lowering; braked; and held in a suspended

position for a minimum of

- 5 minutes with the test load evenly distributed on the platform.
- After proof testing, a competent person shall inspect the platform and rigging to determine if the test has been passed. If any deficiencies are found that pose a safety hazard, the platform and rigging cannot be used to hoist personnel unless the deficiencies are corrected; the test is repeated; and a competent person determines that the test has been passed.
- Do not conduct personnel hoisting until the competent person determines that the platform and rigging have successfully passed the proof test.

4.23.12 Personnel Platform Lifting Procedures

- Personnel are only allowed to ride in a personnel platform supported by the crane load line attachment or boom-mounted platform when used in accordance with the requirements of jurisdictional regulations and standards, and the crane manufacturer's instructions. The crane may not be used for other purposes while handling personnel.
- When using equipment to hoist workers, the workers shall be in a personnel platform that meets the requirements of this procedure.
- Do not load the personnel platform in excess of its rated capacity.
- Personnel platforms will be used only for workers, their tools, and the materials necessary to do their work. Platforms shall not be used to hoist materials or tools when not hoisting personnel.
- Exception: Materials and tools to be used during the lift, if properly secured and distributed may be placed in the platform for trial lifts.
- Materials and tools shall be:
 - Secured to prevent displacement.
 - Evenly distributed within the confines of the platform while it is suspended.
- The number of workers occupying the personnel platform will not exceed the maximum number the platform was designed to hold, or the number required to perform the work, whichever is less.
- Perform the hoisting of the personnel platform in a slow, controlled, cautious manner, with no sudden movements of the equipment or the platform.
- Platform occupants shall:
 - Keep all parts of the body inside the platform during raising, lowering, and horizontal movement. This provision does not apply to an occupant of the platform when necessary to position the platform or while performing the duties of a signal person.
 - Not stand, sit on, or work from the top or intermediate rail or toe board, or use any other means/device to raise their working height.
 - Not pull the platform out of plumb in relation to the hoisting equipment.
- Before workers exit or enter a hoisted personnel platform that is not landed, the platform shall be secured to the structure where the work is to be performed, unless securing to the structure would create a greater hazard.
- If the platform is tied to the structure, the operator shall not move the platform until the operator receives confirmation that it is freely suspended.
- Use tag lines when necessary to control the platform.
- Environmental conditions.

- Wind. When wind speed (sustained or gusts) exceeds 20 miles per hour (32 kilometers per hour) at the personnel platform, a qualified person shall determine if, in light of the wind conditions, it is not safe to lift personnel. If it is not, the lifting operation will not begin (or, if already in progress, will be terminated).
- Other weather and environmental conditions. A qualified person shall determine if, in light of indications of dangerous weather conditions, or other impending or existing danger, it is not safe will not begin (or, if already in progress, will be terminated).
- Workers being hoisted shall remain in direct communication with the signal person (where used), or the operator.
- Fall protection
 - Except over water, workers occupying the personnel platform shall be provided and use a personal fall arrest system. The system shall be attached to a structural member within the personnel platform.
 - The fall arrest system, including the attachment point (anchorage) shall meet the requirements of *S3AM-304-PR1 Fall Protection*.
- Other load lines
 - Do not make lifts on any other of the equipment's load lines while personnel are being hoisted, except in pile driving operations.
 - Factory-produced boom-mounted personnel platforms that incorporate a winch as original equipment: Loads are permitted to be hoisted by such a winch while workers occupy the personnel platform only where the load on the winch line does not exceed 500 pounds (227 kilograms), and does not exceed the rated capacity of the winch and platform.
- Traveling – Equipment other than derricks
 - Hoisting of workers while the equipment is traveling is prohibited.
- Traveling – Derricks.
 - Derricks are prohibited from traveling while personnel are hoisted.

4.23.13 Pre-lift meeting. A pre-lift meeting will be:

- Held to review the applicable requirements of this section and the procedures that will be followed, including the completed *S3AM-310-FM11 Personnel Platform Lifting* or equivalent.
- Attended by the equipment operator, signal person (if used for the lift), workers to be hoisted, and the person responsible for the task to be performed.
- Held prior to the trial lift at each new work location, and repeated for any workers newly assigned to the operation.

4.24 Floating Cranes/Derricks and Land Cranes/Derricks on Barges

4.24.1 This section contains supplemental requirements for floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels, or other means of flotation (vessel/flotation device). The requirements of this section do not apply when using jacked barges when the jacks are deployed to the river/lake/sea-bed, and the barge is fully supported by the jacks.

4.24.2 Additional Safety devices. In addition to the safety devices listed in this procedure, the following safety devices are required:

- Barge, pontoon, vessel, or other means of flotation list and trim device will be located in the cab; or, where there is no cab, at the operator's station.
- Horn.

- Positive equipment house lock.
- Wind speed and direction indicator. A competent person will determine if wind is a factor that needs to be considered; if so, a wind speed and direction indicator will be used.

4.24.3 Operational aids.

- An anti-two-block device is required only when hoisting personnel or hoisting over an occupied cofferdam or shaft.
- Load weighing and similar devices (e.g., load moment (or rated capacity) indicator, load moment (or rated capacity) limiter, automatic overload prevention device, etc.) do not apply to dragline, clamshell (grapple), magnet, drop ball, container handling, concrete bucket, and pile driving equipment manufactured prior to November 8, 2011.

4.24.4 Accessibility of procedures applicable to equipment operation. If the crane/derrick has a cab, the requirements of this procedure apply. If the crane/derrick does not have a cab:

- Rated capacities (load charts) shall be posted at the operator's station. If the operator's station is moveable (such as with pendant-controlled equipment), the load charts shall be posted on the equipment.
- Procedures applicable to the operation of the equipment (other than load charts), recommended operating speeds, special hazard warnings, instructions and operators manual, shall be readily available on board.

4.24.5 Inspections. In addition to meeting the requirements of this procedure for inspecting the crane/derrick, the manager (or his/her designee) shall confirm that the barge, pontoons, vessel, or other means of flotation used to support a floating crane/derrick or land crane/derrick is inspected as follows:

- Shift. The means used to secure/attach the equipment to the vessel/flotation device shall be inspected for wear, corrosion, loose or missing fasteners, defective welds, and, where applicable, insufficient tension.
- Monthly. Inspect the vessel/flotation device used as follows:
 - The means used to secure/attach the equipment to the vessel/flotation device shall be inspected for wear, corrosion, loose or missing fasteners, defective welds, and, where applicable, insufficient tension.
 - Evidence of taking on water.
 - Deck load for proper securing.
 - Chain lockers, storage, fuel compartments and battening of hatches for serviceability as a water-tight appliance.
 - Firefighting and lifesaving equipment in place and functional.
- The shift and monthly inspections shall be conducted by a competent person. If any deficiency is identified, an immediate determination will be made by a qualified person as to whether the deficiency constitutes a hazard. If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.
- Annual: External vessel/flotation device inspection.
 - The external portion of the barge, pontoons, vessel, or other means of flotation used shall be inspected annually by a qualified person who has expertise with respect to vessels/flotation devices. The inspection shall include the following items:
 - The items identified in requirements of this section.
 - Cleats, bitts, chocks, fenders, capstans, ladders, and stanchions for significant

corrosion, wear, deterioration, and deformation.

- External evidence of leaks and structural damage.
- Four-corner draft readings.
- Firefighting equipment for serviceability.
- Rescue skiffs, lifelines, work vests, life preservers and ring buoys shall be inspected for proper condition.
- If any deficiency is identified, an immediate determination will be made by the qualified person as to whether the deficiency constitutes a hazard; or, although not yet a hazard, needs to be monitored in the monthly inspections. If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.
- If the qualified person determines that, although not currently a hazard, the deficiency needs to be monitored, the manager (or his/her designee) shall confirm that the deficiency is checked in the monthly inspections.
- Quadrennial: Internal vessel/flotation device inspection:
 - The internal portion of the barge, pontoons, vessel, or other means of flotation used shall be surveyed once every 4 years by a marine engineer, marine architect, licensed surveyor, or other qualified person who has expertise with respect to vessels/flotation devices.
 - If any deficiency is identified, an immediate determination will be made by the surveyor as to whether the deficiency constitutes a hazard; or, although not yet a hazard, needs to be monitored in the monthly inspections as appropriate.
 - If the deficiency is determined to constitute a hazard, the vessel/flotation device shall be removed from service until it has been corrected.
 - If the surveyor determines that, although not currently a hazard, the deficiency needs to be monitored, the manager (or his/her designee) shall confirm that the deficiency is checked in the monthly or annual inspections as appropriate.
- Documentation. The required monthly, annual and quadrennial inspections shall be documented in accordance with this procedure. The quadrennial inspection shall be retained for a minimum of 4 years.

4.24.6 Working with a diver. The following additional requirements apply when working with a diver in the water:

- If a crane/derrick is used to get a diver into and out of the water, it cannot be used for any other purpose until the diver is back on board. When used for more than one diver, it cannot be used for any other purpose until all divers are back on board.
- The operator shall remain at the controls of the crane/derrick at all times.
- In addition to the signal requirements in this procedure; either:
 - A clear line of sight shall be maintained between the operator and tender of the diver, or
 - The signals between the operator and tender of the diver shall be transmitted electronically.
- The means used to secure the crane/derrick to the vessel/flotation device cannot allow any amount of shifting in any direction.

- 4.24.7 The manager (or his/her designee) shall confirm that the manufacturer's specifications and limitations with respect to environmental, operational, and in-transit load for the barge, pontoons, vessel, or other means of flotation are not exceeded or violated.
- 4.24.8 Floating cranes/derricks. For equipment designed by the manufacturer (or manager or his/her designee) for marine use by permanent attachment to barges, pontoons, vessels, or other means of flotation:
- Load Charts
 - The manufacturer's load charts applicable to operations on water cannot be exceeded. When using these charts, the manager (or his/her designee) shall comply with all parameters and limitations (such as dynamic/environmental parameters) applicable to the use of the charts.
 - The load charts will take into consideration a minimum wind speed of 40 miles per hour (64 kilometers per hour).
 - The requirements for maximum allowable list and maximum allowable trim as specified below shall be met.

Rated Capacity	Maximum Allowable List	Maximum Allowable Trim
Equipment designed for marine use by permanent attachment (other than derricks):		
25 tons or less	5 degrees	5 degrees
Over 25 tons	7 degrees	7 degrees
Derricks designed for marine use by permanent attachment:		
Any rated capacity	10 degrees	10 degrees

- If the equipment is manager (or his/her designee)-made, it is not permitted to be used unless the manager (or his/her designee) has documents demonstrating that the load charts and applicable parameters for use meet the requirements of this section. Such documents shall be signed by a registered professional engineer who is a qualified person with respect to the design of this type of equipment (including the means of flotation).
 - The barge, pontoons, vessel, or other means of flotation used shall:
 - Be structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derricks' maximum-rated capacity with all anticipated deck loads and ballasted compartments.
 - Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free-surface effect.
 - Have access to void compartments to allow for inspection and pumping.
- 4.24.9 Land cranes/derricks. For land cranes/derricks used on barges, pontoons, vessels, or other means of flotation:
- The rated capacity of the equipment (load charts) applicable for use on land shall be reduced to:
 - Account for increased loading from list, trim, wave action, and wind.
 - Be applicable to a specified location(s) on the specific barge, pontoons, vessel, or other means of flotation that will be used, under the expected environmental conditions.
 - The rated capacity modification shall be done by the equipment manufacturer, or a qualified

person who has expertise with respect to both land crane/derrick capacity, and the stability of vessels/flotation devices.

- List and trim.
 - The maximum allowable list and the maximum allowable trim cannot exceed the least of the following: 5 degrees, the amount specified by the crane/derrick manufacturer; or, where an amount is not so specified, the amount specified by the qualified person.
 - The maximum allowable list and the maximum allowable trim for the barge, pontoon, vessel, or other means of flotation cannot exceed the amount necessary to confirm that following conditions are met:
 - All deck surfaces of the barge, pontoons, vessel, or other means of flotation used shall be above water.
 - The entire bottom area of the barge, pontoons, vessel, or other means of flotation used shall be submerged.
- Physical attachment, corraling, rails system, and centerline cable system. The manager (or his/her designee) shall meet the requirements in Option 1, Option 2, Option 3, or Option 4, as follows.
 - Option 1 – Physical attachment. The crane/derrick shall be physically attached to the barge, pontoons, vessel, or other means of flotation. Methods of physical attachment include crossed-cable systems attached to the crane/derrick and vessel flotation device (this type of system allows the crane/derrick to lift up slightly from the surface of the vessel/means of flotation), bolting or welding the crane/derrick to the vessel/flotation device, strapping the crane/derrick to the vessel/flotation device with chains, or other methods of physical attachment.
 - Option 2 – Corraling. The crane/derrick shall be prevented from shifting by installing barricade restraints (a corraling system). Corraling systems shall not allow any amount of shifting in any direction by the equipment.
 - Option 3 – Rails. The crane/derrick shall be prevented from shifting by being mounted on a rail system. Rail clamps and rail stops are required unless the system is designed to prevent movement during operation by other means.
 - Option 4 – Centerline cable system. The crane/derrick shall be prevented from shifting by being mounted to a wire rope system. The wire rope system shall meet the following requirements:
 - The wire rope and attachments shall be of sufficient size/strength to support the side load of crane/derrick.
 - The wire rope shall be physically attached to the vessel/flotation device.
 - The wire rope shall be attached to the crane/derrick by appropriate attachment methods (such as shackles or sheaves) on the undercarriage, which will allow the crew to secure the crane/derrick from movement during operation, and to move the crane/derrick longitudinally along the vessel/flotation device for repositioning.
 - A method will be employed to prevent the crane/derrick from passing the forward or aft end of the wire rope attachments.
 - The crane/derrick shall be secured from movement during operation.
 - Whichever Option is used, the systems/means used to comply with the Option will be designed by a marine engineer, registered professional engineer familiar with floating crane/derrick design, or qualified person familiar with floating crane/derrick design.

- Exception. For mobile auxiliary cranes used on the deck of a floating crane/derrick, the requirement to use Option 1, Option 2, Option 3, or Option 4 of this section does not apply where the manager (or his/her designee) demonstrates implementation of a plan and procedures that meet the following requirements:
 - A marine engineer or registered professional engineer familiar with floating crane/derrick design develops and signs a written plan for the use of the mobile auxiliary crane.
 - The plan shall be designed so that the applicable requirements of this section will be met despite the position, travel, operation, and lack of physical attachment (or corraling, use of rails, or cable system) of the mobile auxiliary crane.
 - The plan shall specify the areas of the deck where the mobile auxiliary crane is permitted to be positioned, travel, and operate, and the parameters/limitations of such movement and operation.
 - The deck shall be marked to identify the permitted areas for positioning, travel, and operation.
 - The plans all specify the dynamic/environmental conditions that shall be present for use of the plan. If the specified dynamic/environmental conditions are exceeded, the mobile auxiliary crane shall be physically attached or corralled in accordance with Option 1, Option 2, Option 3, or Option 4.
- The barge, pontoons, vessel, or other means of flotation used shall:
 - Be structurally sufficient to withstand the static and dynamic loads of the crane/derrick when operating at the crane/derrick's maximum rated capacity with all anticipated deck loads and ballasted compartments.
 - Have a subdivided hull with one or more longitudinal watertight bulkheads for reducing the free surface effect.
 - Have access to void compartments to allow for inspection and pumping.

4.25 Dedicated pile drivers.

- 4.25.1 The provisions of this procedure apply to dedicated pile drivers, except as specified in this section.
- 4.25.2 Information provided elsewhere in this standard on anti two-block devices does not apply.
- 4.25.3 Operator Qualification and Certification applies, except that the qualification or certification will be for operation of either dedicated pile drivers, or equipment that is the most similar to dedicated pile drivers.
- 4.25.4 The industrial site or project specific SH&E Plan shall include minimum safe work distances for workers adjacent to all pile driving operations.
 - At a minimum, employees shall maintain a distance of at least two pile lengths from where piles are being cut and dropped, other than in situations where cut piles are being guided to the ground utilizing mechanical means (e.g., pile driver and shackle) to control the direction and speed of fall of the cut pile.

4.26 Overhead and Gantry Cranes

- 4.26.1 The requirements of this procedure apply to the following equipment when used in construction: Overhead and gantry cranes, including semi-gantry, cantilever gantry, wall cranes, storage bridge cranes, and others having the same fundamental characteristics.

4.27 Derricks

4.27.1 This section contains supplemental requirements for derricks, whether temporarily or permanently mounted; all sections of this procedure apply to derricks unless specified otherwise. A derrick is powered equipment consisting of a mast or equivalent member that is held at or near the end by guys or braces, with or without a boom, and its hoisting mechanism. The mast/equivalent member and/or the load are moved by the hoisting mechanism (typically base-mounted) and operating ropes. Derricks include A-frame, basket, breast, Chicago boom, gin pole (except gin poles used for erection of communication towers), guy, shear leg, and variations of such equipment.

4.27.2 Operation of Derricks

- “Operation” applies except for “accessibility of procedures”.
- Load chart contents. Load charts shall contain at least the following information:
 - Rated capacity at corresponding ranges of boom angle or operating radii.
 - Specific lengths of components to which the rated capacities apply.
 - Required parts for hoist reeving.
 - Size and construction of rope will be included on the load chart or in the operating manual.
- Load chart location.
 - Permanent installations. For permanently installed derricks with fixed lengths of boom, guy, and mast, a load chart shall be posted where it is visible to personnel responsible for the operation of the equipment.
 - Non-permanent installations. For derricks that are not permanently installed, the load chart shall be readily available at the job site to personnel responsible for the operation of the equipment.

4.27.3 Construction of Derricks

- General requirements
 - Derricks shall be constructed to meet all stresses imposed on members and components when installed and operated in accordance with the manufacturer’s/builder’s procedures, and within its rated capacity.
 - Welding of load-sustaining members shall conform to recommended practices of the applicable jurisdictional standard (e.g. ANSI, CSA).
- Guy derricks.
 - The minimum number of guys will be six, with equal spacing, except where a qualified person or derrick manufacturer approves variations from these requirements and revises the rated capacity to compensate for such variations.
 - Guy derricks will not be used unless the manager (or his/her designee) has the following guy information:
 - The number of guys.
 - The spacing around the mast.
 - The size, grade, and construction of rope to be used for each guy.
 - For guy derricks manufactured after December 18, 1970 the manager (or his/her designee) shall have the following additional guy information:
 - The amount of initial sag or tension.
 - The amount of tension in guy line rope at anchor.
 - The mast base shall permit the mast to rotate freely, with allowance for slight tilting of the

mast caused by guy slack.

- The mast cap shall:
 - Permit the mast to rotate freely.
 - Withstand tilting and cramping caused by the guy loads.
 - Be secured to the mast to prevent disengagement during erection.
 - Be provided with means for attaching guy ropes.
- Stiff leg derricks.
 - The mast will be supported in the vertical position by at least two stiff legs: one end of each will be connected to the top of the mast, and the other end securely anchored.
 - The stiff legs shall be capable of withstanding the loads imposed at any point of operation within the load chart range.
 - The mast base shall:
 - Permit the mast to rotate freely (when necessary).
 - Permit deflection of the mast without binding.
 - The mast shall be prevented from lifting out of its socket when the mast is in tension.
 - The stiff leg connecting member at the top of the mast shall:
 - Permit the mast to rotate freely (when necessary).
 - Withstand the loads imposed by the action of the stiff legs.
 - Be secured so as to oppose separating forces.
- Gin pole derricks.
 - Guy lines shall be sized and spaced so as to make the gin pole stable in both boomed and vertical positions. Exception: Where the size and/or spacing of guy lines do not result in the gin pole being stable in both boomed and vertical positions, the manager (or his/her designee) shall confirm that the derrick is not used in an unstable position.
 - The base of the gin pole shall permit movement of the pole (when necessary).
 - The gin pole shall be anchored at the base against horizontal forces (when such forces are present).
- Chicago boom derricks. The fittings for stepping the boom and for attaching the topping lift shall be arranged to:
 - Allow the derrick to swing at all permitted operating radii and mounting heights between fittings.
 - Accommodate attachment to the upright member of the host structure.
 - Withstand the forces applied when configured and operated in accordance with the manufacturer's/builder's procedures, and within its rated capacity.
 - Prevent the boom or topping lift from lifting out under tensile forces.

4.27.4 Anchoring and guying of derricks

- Load anchoring data developed by the manufacturer or a qualified person shall be used.
- Guy derricks.
 - Anchor the mast base.

- Secure the guys to the ground or other firm anchorage.
- Design the anchorage and guying to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular guy slope and spacing specified for the application.
- Stiff Leg derricks.
 - Anchor the mast base and stiff legs.
 - Design the anchorage and guying to withstand maximum horizontal and vertical forces encountered when operating within rated capacity with the particular stiff leg spacing and slope specified for the application.

4.27.5 Swingers and hoists

- The boom, swinger mechanisms, and hoists shall be suitable for the derrick work intended, and shall be anchored to prevent displacement from the imposed loads.
- Base-mounted drum hoists.
 - Base-mounted drum hoists shall meet the requirements specified by the applicable jurisdictional regulations and/or standards.
 - Load tests for new hoists. The manager (or his/her designee) shall confirm that new hoists are load tested to a minimum of 110 percent of rated capacity, but not more than 125 percent of rated capacity, unless otherwise recommended by the manufacturer. This requirement is met where the manufacturer has conducted this testing.
 - Repaired or modified hoists. Hoists that have had repairs, modifications, or additions affecting their capacity or safe operation shall be evaluated by a qualified person to determine if a load test is necessary.
 - Load test procedure. Required load tests shall be conducted as follows:
 - Hoist the test load a vertical distance to assure that the load is supported by the hoist and held by the hoist brake(s).
 - The test load will be lowered, stopped, and held with the brake(s).
 - Do not use the hoist unless a competent person determines that the test has been passed.

4.27.6 Operational Aids for derricks

- Operational Aids requirements identified in this procedure apply, except for “Boom hoist limiting device” and “Boom angle or radius indicator” and “Load weighing and similar devices.”
- Boom angle aid. The manager (or his/her designee) shall confirm that either:
 - The boom hoist cable is marked with caution and stop marks. The stop marks correspond to maximum and minimum allowable boom angles. The caution and stop marks are in view of the operator, or a spotter who is direct communication with the operator; or
 - An electronic or other device that signals the operator in time to prevent the boom from moving past its maximum and minimum angles, or automatically prevents such movement, is used.
- Load weight/capacity devices. Derricks manufactured more than 1 year after November 8, 2010 with a maximum rated capacity over 6,000 pounds shall have at least one of the following: load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter. Temporary alternative measures: the weight of the load shall be determined from a reliable source (such as the load’s manufacturer), by a reliable calculation method (such as calculating a steel beam from measured dimensions and a known per-foot weight), or

by other equally reliable means. This information will be provided to the operator prior to the lift.

4.27.7 Post-assembly approval and testing – new or reinstalled derricks

- Anchorages
 - Anchorages, including the structure to which the derrick is attached (if applicable), shall be approved by a qualified person.
 - If using a rock or hairpin anchorage, the qualified person shall determine if any special testing of the anchorage is needed. If so, it will be tested accordingly.
- Functional test. Prior to initial use, new or reinstalled derricks shall be tested by a competent person with no hook load to verify proper operation. This test shall include:
 - Lifting and lowering the hook(s) through the full range of hook travel.
 - Raising and lowering the boom through the full range of boom travel.
 - Swinging in each direction through the full range of swing.
 - Actuating the anti-two-block and boom-hoist-limit devices (if provided).
 - Actuating locking, limiting, and indicating devices (if provided).
- Load test. Prior to initial use, new or reinstalled derricks shall be load tested by a competent person. The test load shall meet the following requirements:
 - Test loads shall be at least 100 percent, and no more than 110 percent, of the rated capacity, unless otherwise recommended by the manufacturer or qualified person, but in no event shall the test load be less than the maximum anticipated load.
 - The test shall consist of:
 - Hoisting the test load a few inches and holding to verify that the load is supported by the derrick and held by the hoist brake(s).
 - Swinging the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load.
 - Lowering, stopping, and holding the load with the brake(s).
 - The derrick is not permitted to be used unless the competent person determines that the test has been passed.
- Documentation. Tests conducted under this paragraph will be documented. The document will be retained until the derrick is re-tested or dismantled, whichever occurs first.

4.27.8 Load testing repaired or modified derricks. Derricks that have had repairs, modifications for additions affecting the derrick's capacity or safe operation shall be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing shall be conducted and documented.

4.27.9 Power failure procedures. If power fails during operations, the derrick operator shall safely stop operations. This includes:

- Setting all brakes or locking devices.
- Moving all clutch and other power controls to the off position.

4.27.10 Use of winch heads

- Do not handle ropes on a winch head without the knowledge of the operator.
- While a winch head is being used, the operator shall be within reach of the power unit control lever.

4.27.11 Securing the boom

- When the boom is being held in a fixed position, engage dogs, pawls, or other positive holding mechanisms on the boom hoist.
- When taken out of service for 30 days or more, secure the boom by one of the following methods:
 - Lay it down.
 - Secure it to a stationary member, as nearly under the head as possible, by attachment of a sling to the load block.
 - For guy derricks, lift to a vertical position and secure to the mast.
 - For stiff leg derricks, secure against the stiff leg.

4.27.12 The process of jumping the derrick shall be supervised by the A/D supervisor.

4.27.13 Derrick operations shall be supervised by a competent person.

4.27.14 Inspections. In addition to the requirements in this procedure, the following additional items shall be included in the inspections of derricks:

- Daily: Guys for proper tension.
- Annual:
 - Gudgeon pin for cracks, wear, and distortion.
 - Foundation supports for continued ability to sustain the imposed loads.

4.28 Side-Boom Cranes and Boom-Truck Procedures

4.28.1 Prior to the manipulation of any controls, operators are to confirm that all personnel are clear of all moving parts.

4.28.2 The operator is in control of all operations associated with side-boom crane or boom truck.

4.28.3 The boom truck operator shall confirm the THA and boom truck hazard checklist have been performed and reviewed and signed by all parties prior to working with boom truck. Refer to *S3AM-310-FM10 Boom Truck Checklist*.

4.28.4 Only approved access and egress points on/off the bed of the truck shall be used.

4.29 Equipment with Rated Hoisting/Lifting Capacity of 2,000 pounds (907 kilograms) or less.

4.29.1 The manager shall confirm the operator is trained and competent to operate lifting equipment.

4.29.2 Proper planning shall be conducted, including, but not limited to:

- Complete a THA for the proposed task.
- Inspect the lifting equipment pre-operation and in accordance with manufacturer specifications.
- Accurately establish load weight, including rigging equipment, and confirming it is within the lifting capacity of the lifting equipment.
- Assess weather conditions for potential impacts and ground conditions for stability and levelness.
- As applicable, select appropriate wire rope, install properly and inspect according to this procedure.
- Verify the presence of and proper operation of manufacturer supplied safety devices.
- Adequately identify work area to prevent unauthorized entry.

- Where overhead power lines are present, conduct operations in accordance with this procedure.

4.29.3 Operators shall comply with all the manufacturer's procedures applicable to the operational functions of equipment, including its use with attachments.

5.0 Records

- 5.1 All training records shall be maintained in accordance with *S3AM-003-PR1 SH&E Training*.
- 5.2 All inspection records will be maintained on site with the machine. This will include, but not be limited to:
- Equipment inspections;
 - Equipment tests; and
 - Repairs, modifications and/or maintenance of the lifting device.
- 5.3 Critical Lift Plans, signed off Assembly – Disassembly Procedures, Lift Classifications and any other documentation completed relating to the lifting tasks shall be maintained in the program or project files.

6.0 Attachments

- 6.1 [S3AM-310-ATT1](#) [Definitions](#)
- 6.2 [S3AM-310-ATT2](#) [Standard Hand Signals](#)
- 6.3 [S3AM-310-ATT3](#) [Rigging](#)
- 6.4 [S3AM-310-ATT4](#) [Wire Rope Safety Factors](#)
- 6.5 [S3AM-310-ATT5](#) [Checklist for Lift Planning](#)
- 6.6 [S3AM-310-FM1](#) [Initial & Annual Crane Inspection](#)
- 6.7 [S3AM-310-FM2](#) [Lift Classification](#)
- 6.8 [S3AM-310-FM3](#) [Critical Lift Plan](#)
- 6.9 [S3AM-310-FM4](#) [Daily Crane Inspection](#)
- 6.10 [S3AM-310-FM5](#) [Monthly Crane Inspection](#)
- 6.11 [S3AM-310-FM6](#) [Monthly Wire Rope / Hook Inspection](#)
- 6.12 [S3AM-310-FM7](#) [Monthly Synthetic Sling Inspection](#)
- 6.13 [S3AM-310-FM8](#) [Monthly Shackle Inspection](#)
- 6.14 [S3AM-310-FM9](#) [Monthly Rigging Inspection](#)
- 6.15 [S3AM-310-FM10](#) [Boom Truck Checklist](#)
- 6.16 [S3AM-310-FM11](#) [Personnel Platform Lifting](#)
- 6.17 [S3AM-310-FM12](#) [Assembly – Disassembly Procedure](#)

Americas

Initial & Annual Crane Inspection

S3NA-310-FM1

EQ. Number:	Machine Hours:	Date:	Manufacturer:	Model:	Capacity:	Serial Number:	Location:
Codes: <input checked="" type="checkbox"/> Satisfactory <input checked="" type="checkbox"/> Not Satisfactory - Not applicable			Crane Type <input type="checkbox"/> Gantry <input type="checkbox"/> Crawler <input type="checkbox"/> Truck <input type="checkbox"/> RT <input type="checkbox"/> Tower				

GENERAL CHECKS
1. <input type="checkbox"/> Operator's Manual/Configuration Drawings 2. <input type="checkbox"/> Hand Signal Sign 3. <input type="checkbox"/> Anti–Two-Block Warning Sign 4. <input type="checkbox"/> High–Voltage Warning Sign 5. <input type="checkbox"/> Capacity Chart 6. <input type="checkbox"/> Warning Horn 7. <input type="checkbox"/> Fire Extinguisher 8. <input type="checkbox"/> Boom-Angle Indicator 9. <input type="checkbox"/> Back-up Alarm 10. <input type="checkbox"/> Anti–Two-Block Device (Main) 11. <input type="checkbox"/> Anti–Two-Block Device (Auxiliary) 12. <input type="checkbox"/> Load-Moment Indicator 13. <input type="checkbox"/> Handholds and Steps 14. <input type="checkbox"/> Non-Skid Surfaces 15. <input type="checkbox"/> Catwalks and Handrails 16. <input type="checkbox"/> Tailswing Barrier 17. <input type="checkbox"/> Housekeeping, Interior 18. <input type="checkbox"/> General Appearance, Exterior 19. <input type="checkbox"/> Operator's Seat 20. <input type="checkbox"/> Controls Marked 21. <input type="checkbox"/> Cab Glass 22. <input type="checkbox"/> Drum Turn Indicator 23. <input type="checkbox"/> Directional Signals 24. <input type="checkbox"/> Head, Tail and Brake Lights 25. <input type="checkbox"/> Fluid Levels and Fluid Condition
CRANE CONFIGURATION COMPLIES WITH MANUFACTURER'S DESIGN
1. <input type="checkbox"/> Counterweights 2. <input type="checkbox"/> Boom Type for Application 3. <input type="checkbox"/> Boom Section Location 4. <input type="checkbox"/> Pendant Length Relationship 5. <input type="checkbox"/> Gantry Position 6. <input type="checkbox"/> Mast Position 7. <input type="checkbox"/> Boom Hoist Reeving/Bridle 8. <input type="checkbox"/> Jib Suspension Reeving 9. <input type="checkbox"/> Wire Rope Type/Size 10. <input type="checkbox"/> Maximum Boom Not Exceeded 11. <input type="checkbox"/> Maximum Jib Not Exceeded
LATTICE BOOM
1. <input type="checkbox"/> Boom Stops 2. <input type="checkbox"/> Boom Hoist Kickout Operation 3. <input type="checkbox"/> Alignment with Revolving Frame 4. <input type="checkbox"/> Butt Section Chords, Lacing, Welds 5. <input type="checkbox"/> First Intermediate Section, Chords, Lacing, Weld Length _____ 6. <input type="checkbox"/> Second Intermediate Section, Chords, Lacing, Weld Length _____ 7. <input type="checkbox"/> Third Intermediate Section, Chords, Lacing, Weld Length _____ 8. <input type="checkbox"/> Fourth Intermediate Section, Chords, Lacing, Weld Length _____ 9. <input type="checkbox"/> Fifth Intermediate Section, Chords, Lacing, Weld Length _____ 10. <input type="checkbox"/> Boom Point Section, Chords, Lacing, Welds, Sheaves, Shaft, Rope Guards, Dead End Device

LATTICE BOOM (Cont.)
11. <input type="checkbox"/> Boom in Storage, Chords, Lacing, Welds Length _____ 12. <input type="checkbox"/> Boom Connecting Pins, Bolts, Keepers 13. <input type="checkbox"/> Boom Hinge Pins, Bushings, Keepers 14. <input type="checkbox"/> Boom Paint Condition 15. <input type="checkbox"/> Boom Top Rollers, Wire Rope Guides 16. <input type="checkbox"/> Boom Repairs are According to Manufacturer's Procedures and Documented
JIB
1. <input type="checkbox"/> Butt Section, Chords, Lacing, Welds, Pins, Keepers 2. <input type="checkbox"/> Intermediate Section, Chords, Lacing, Welds 3. <input type="checkbox"/> Point Section, Chords, Lacing, Welds, Sheaves, Shaft, Keepers 4. <input type="checkbox"/> Jib Mast or Shear Leg 5. <input type="checkbox"/> Jib Stop Installation 6. <input type="checkbox"/> Jib Suspension Condition and Proper Anchoring 7. <input type="checkbox"/> No Unauthorized Repairs
HYDRAULIC BOOM
1. <input type="checkbox"/> Check Operation, Fully Retracting and Extending Boom 2. <input type="checkbox"/> Check for Twists, Bends, Viewing Over Top of Boom 3. <input type="checkbox"/> Check for Bends, Fully Extended, Viewing from Slide 4. <input type="checkbox"/> Check Slide Wear Pads 5. <input type="checkbox"/> Check Wear Pad Side Clearance 6. <input type="checkbox"/> Attaching Shafts/Keepers 7. <input type="checkbox"/> Boom Extension Cylinders 8. <input type="checkbox"/> Boom Extension Cables 9. <input type="checkbox"/> Boom Hoist Cylinders 10. <input type="checkbox"/> Check Visible Welds, Attaching Lugs, Pins and Rollers, Check Top, Side and Bottom Boom Plates for Distortion or Cracking 11. <input type="checkbox"/> Check Point Sheaves 12. <input type="checkbox"/> Check Boom Extension or Jib Chords, Welds, Sheaves, Pins 13. <input type="checkbox"/> Boom Repair According to Manufacturer's Procedures and Documented 14. <input type="checkbox"/> Paint Condition
GANTRY AND BACK HITCH
1. <input type="checkbox"/> Check Welds and Check for Cracks 2. <input type="checkbox"/> Sheaves, Shafts, Pins and Keepers 3. <input type="checkbox"/> Check for Elongated Pin Holes, Stretched Metal 4. <input type="checkbox"/> Lubrication 5. <input type="checkbox"/> Crane Roof Condition

WIRE ROPE AND PENDANTS
1. <input type="checkbox"/> Pendant Lengths Match 2. <input type="checkbox"/> Pendant Pins and Keepers 3. <input type="checkbox"/> Pendant Condition at Sockets, and Broken Wire Check 4. <input type="checkbox"/> Main Hoist Rope Condition/Reeving 5. <input type="checkbox"/> Auxiliary Hoist Rope Condition 6. <input type="checkbox"/> Boom Hoist Rope Condition/Reeving 7. <input type="checkbox"/> All Hoist Rope Dead Ends 8. <input type="checkbox"/> Equalizer Frame, Sheaves, Bearings and Keepers 9. <input type="checkbox"/> Wire Rope Guides/Rollers 10. <input type="checkbox"/> Lubrication and Preservation 11. <input type="checkbox"/> Boom Hoist Rope Certification 12. <input type="checkbox"/> Main Hoist Rope Certification 13. <input type="checkbox"/> Auxiliary Hoist Rope Certification
REVOLVING FRAME, COUNTERWEIGHT
1. <input type="checkbox"/> Check Frame for Cracks and Defects 2. <input type="checkbox"/> House Rollers 3. <input type="checkbox"/> Hook Rollers and Bolts 4. <input type="checkbox"/> Roller Path 5. <input type="checkbox"/> Rotec Bearing and Bolts 6. <input type="checkbox"/> Counterweight Bolts 7. <input type="checkbox"/> "A" Frame and Pins 8. <input type="checkbox"/> Cab Condition
LOAD BLOCK, OVERHAUL BALL
1. <input type="checkbox"/> Check Main Hook for Cracks 2. <input type="checkbox"/> Main Hook Safety Latch 3. <input type="checkbox"/> Check Auxiliary Hook for Cracks 4. <input type="checkbox"/> Auxiliary Hook Safety Latch 5. <input type="checkbox"/> Sheaves, Bearings 6. <input type="checkbox"/> Dead End Sockets 7. <input type="checkbox"/> Load Block Capacity _____ 8. <input type="checkbox"/> Overhaul Ball Capacity _____ 9. <input type="checkbox"/> N.D.T. Main Hook Documentation or Certification by Manufacturer N.D.T. Date _____ 10. <input type="checkbox"/> N.D.T. Auxiliary Hook Documentation or Certification by Manufacturer N.D.T. Date _____
HOIST AND SWING MACHINERY
1. <input type="checkbox"/> Hydraulic Main Hoist 2. <input type="checkbox"/> Hydraulic Auxiliary Hoist 3. <input type="checkbox"/> Hydraulic Swing and Brake 4. <input type="checkbox"/> Hydraulic Supply System 5. <input type="checkbox"/> Hydraulic Controls 6. <input type="checkbox"/> Swing Pinion 7. <input type="checkbox"/> Swing Rock or Gear 8. <input type="checkbox"/> Continuous Rotation Test 9. <input type="checkbox"/> Swing Clutches 10. <input type="checkbox"/> Swing Brake 11. <input type="checkbox"/> Swing or House Lock 12. <input type="checkbox"/> Swing Reversing Gears 13. <input type="checkbox"/> Main Hoist Brake 14. <input type="checkbox"/> Main Hoist Clutch 15. <input type="checkbox"/> Auxiliary Hoist Brake

HOIST AND SWING MACHINERY (Cont.)
16. <input type="checkbox"/> Auxiliary Hoist Clutch 17. <input type="checkbox"/> Third Drum Clutch and Brake 18. <input type="checkbox"/> Boom Hoist Clutch and Brake 19. <input type="checkbox"/> Boom Hoist Dog 20. <input type="checkbox"/> Control Rods and Pins 21. <input type="checkbox"/> Drive Chains 22. <input type="checkbox"/> Drivelines/U-Joints 23. <input type="checkbox"/> Power Down Drive and Operation 24. <input type="checkbox"/> Hoist Gears 25. <input type="checkbox"/> Deck or Travel Gears 26. <input type="checkbox"/> Jaw Clutches, Travel, Swing 27. <input type="checkbox"/> Gear and Drive Guards 28. <input type="checkbox"/> Control Operation, Response 29. <input type="checkbox"/> Gauges 30. <input type="checkbox"/> Lubrication
UPPER ENGINE, TRANSMISSION, T.C.
1. <input type="checkbox"/> Mounting Bolts 2. <input type="checkbox"/> Radiator, Fan, Hoses 3. <input type="checkbox"/> Belts 4. <input type="checkbox"/> Air Cleaner 5. <input type="checkbox"/> Air Compressor Pressure: High _____ Low _____ 6. <input type="checkbox"/> Transmission 7. <input type="checkbox"/> Torque Convertor 8. <input type="checkbox"/> Electrical System/Batteries 9. <input type="checkbox"/> Exhaust System, Rain Cap 10. <input type="checkbox"/> Engine Operation 11. <input type="checkbox"/> _____ 12. <input type="checkbox"/> _____ 13. <input type="checkbox"/> _____ 14. <input type="checkbox"/> _____ 15. <input type="checkbox"/> _____
CARBODY AND CRAWLERS
1. <input type="checkbox"/> Check for Structural Cracks 2. <input type="checkbox"/> Center Pin Bushing 3. <input type="checkbox"/> Travel Shaft Gears 4. <input type="checkbox"/> Lower Jaw Clutches 5. <input type="checkbox"/> Travel Brakes and Dogs 6. <input type="checkbox"/> Axles and Fasteners 7. <input type="checkbox"/> Travel Chains 8. <input type="checkbox"/> Travel Sprockets 9. <input type="checkbox"/> Carrier Rollers, Slide Metal 10. <input type="checkbox"/> Bottom Rollers 11. <input type="checkbox"/> Pad Lugs and Roller Path 12. <input type="checkbox"/> Pad Pin Wear and Locks 13. <input type="checkbox"/> Travel Motors, Hydraulic, Electric 14. <input type="checkbox"/> Travel Reduction Gear Case 15. <input type="checkbox"/> Hydraulic Supply System 16. <input type="checkbox"/> Crawler Extension Mechanism 17. <input type="checkbox"/> Lubrication
CARRIER
1. <input type="checkbox"/> Outrigger Operation 2. <input type="checkbox"/> Outrigger Structure and Pads 3. <input type="checkbox"/> Frame, Cracks and Welds 4. <input type="checkbox"/> Drive, Axles, Linkage

CARRIER (Cont.)
5. <input type="checkbox"/> Steering Axles, Linkage 6. <input type="checkbox"/> Wheel Lug Nuts 7. <input type="checkbox"/> Tire Condition, Pressures 8. <input type="checkbox"/> Steering Apparatus 9. <input type="checkbox"/> Cab, Seat, Gauges, Horn 10. <input type="checkbox"/> Radiator, Hoses, Supports 11. <input type="checkbox"/> Engine Operation and Mounts 12. <input type="checkbox"/> Belts 13. <input type="checkbox"/> Air Cleaner 14. <input type="checkbox"/> Alternator, Batteries 15. <input type="checkbox"/> Main Transmission or Converter 16. <input type="checkbox"/> Auxiliary Transmission or Transfer Case 17. <input type="checkbox"/> Air Compressor 18. <input type="checkbox"/> Record Air Pressures: High _____ Low _____ 19. <input type="checkbox"/> Service Brakes 20. <input type="checkbox"/> Brake Hoses 21. <input type="checkbox"/> Parking Brake/Safety Brakes 22. <input type="checkbox"/> Exhaust System 23. <input type="checkbox"/> Hydraulic Supply 24. <input type="checkbox"/> Lubrication
LOAD ENHANCEMENT DEVICE
1. <input type="checkbox"/> Ringer Type 2. <input type="checkbox"/> Skyhorse 3. <input type="checkbox"/> Linkbelt Heavy Life Type 4. <input type="checkbox"/> Configuration Complies with Manufacturer's Design 5. <input type="checkbox"/> Integrity
MISCELLANEOUS
1. <input type="checkbox"/> Log Book, In Machine and Up to Date 2. <input type="checkbox"/> All Safety Decals & Warning on Machine 3. <input type="checkbox"/> _____ 4. <input type="checkbox"/> _____ 5. <input type="checkbox"/> _____

NOTE: Make sure deficient items are noted and corrected. (File in Record Book)

Inspection Date:_____

Inspector:_____

Comments:_____

CRANE LOAD TEST			
MAXIMUM LOAD REQUIRED		AT RADIUS	WITH BOOM LENGTH
CRAWLER POSITION		OUTRIGGER POSITION	
<input type="checkbox"/> Extended <input type="checkbox"/> Retracted		<input type="checkbox"/> Full <input type="checkbox"/> Intermediate <input type="checkbox"/> Retracted	
SUPERSTRUCTURE POSITION	LOAD/POUNDS	RADIUS/FT	BOOM LENGTH
1.			
2.			
3.			
RESULTS OF TEST: <input type="checkbox"/> Passed <input type="checkbox"/> Failed			
REMARKS:			
Inspected By (Please Print):		Title:	
Signature:		Date:	
Operator (Please Print):		Date:	
Signature:		Date:	
Repairs Completed By:		Date:	

1. Regulations/Standards
- A. Annual inspections are required by various jurisdictional regulations and standards, and as such shall be conducted by a competent person, or by a government or private agency recognized by the applicable jurisdictional regulatory body. AECOM shall maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

B. Monthly inspections are also required by various jurisdictional regulations and standards and shall:
 - Conducted monthly on critical items in use such as brakes, crane hooks, and ropes
 - Written, dated, and signed.
 - Records shall be kept where readily available.
2. The mobile, hydraulic, and crawler crane inspector and operator should be familiar with the requirements of the regulations and standards of the applicable jurisdiction.
3. In addition, regulations sometimes found in nuclear plant construction, marine construction or areas covered by more stringent local laws may require compliance with some or all of the following:

A. Load Moment Indicators

B. Manufacturers’ or suppliers’ certification of breaking strengths of boom hoist, main hoist, and auxiliary hoist ropes. Whenever replacement ropes are purchased, the certification should be requested from the supplier and kept with the equipment records.

C. Non-destructive testing of load hooks or certification by the hook and block manufacturer.

D. Load testing, not to exceed 110 percent of rated load at specific radii with the superstructure in various positions or swinging 360°. Limitations based on structural strength should never be exceeded.

E. Provisions are made for A, B, C, and D in this inspection form if required.

4. No modifications will be made to any of the load-carrying parts or structure of any crane, without written approval of the manufacturer.

5. Welding repairs to booms are to be made according to procedures established by the manufacturer. Booms thus repaired are to be load tested between 100 and 110 percent of rated load prior to being placed back in service.

6. Checks peculiar to a machine may be written under the “Miscellaneous Checks” heading.

7. All inspection reports must be dated and signed.

8. Where discrepancies exist, explain the discrepancies in the “Remarks” section.

9. Wire rope must be taken out of service when any of the following conditions exist:

A. In running ropes, six randomly distributed wires in one lay, or three broken wires in one strand in one lay.

B. Wear 1/3 the original diameter of outside individual wires; kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.

C. Evidence of heat damage from any cause.

D. Reductions from nominal diameter of more than 1/64” for diameters up to and including 5/16”; 1/32” for diameters 3/8” to and including 1/2”; 3/64” for diameters 9/16” to and including 3/4”; 1/16” for diameters 7/8”.

E. In standing ropes, more than two broken wires in one lay in section beyond end connections or more than one broken wire at end connection.

F. Wire rope safety factors must be in accordance with jurisdictional requirements.

Initial & Annual Crane Inspection (S3NA-310-FM1)
Revision 3 March 1, 2016
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2 of 2

Americas

Lift Classification

S3NA-310-FM2

Date of Lift(s): _____	Contractor/Subcontractor Name: _____	
Project Name & Number: _____	Location of Activity: _____	
Crane Operator: _____	Manager / Supervisor: _____	
<p>The purpose of this checklist is to determine type of lift classification. If any condition and/or situation is not clearly understood or if the lift is identified as Critical, additional documentation and assessment are required.</p> <p>“ALWAYS LOOK UP AND LIVE.” Be aware of overhead hazards, primarily OVERHEAD POWER LINES.</p>		
Description of load to be hoisted:		
Material/Equipment to be Hoisted		
Will the load be lifted, swung, or placed out of the crane operator's view?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will lift require more than one crane or hoisting device?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does this lift require any non-routine or technically difficult rigging arrangements?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Is the load an item of long lead time (to replace if damaged) and could impact project schedule?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will the load be lifted over any structures or equipment?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Will lift take place in a confined or limited access area?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does lift involve hoisting personnel?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does lift supervisor, operator, or management believe this should be considered a critical lift for any other reason (e.g. wind conditions, proximity to overhead electrical lines, etc.)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
If the answer to any of the previous questions is Yes , THIS IS NOW CLASSIFIED A CRITICAL LIFT	<input type="checkbox"/> Yes <input type="checkbox"/> No	
A. Weight of the load to be hoisted:	_____	lbs / kg
B. Weight of the rigging, including the block, jib, and wire rope:	_____	lbs / kg
C. Total weight of the lift (Sum of load weight [Row A] and rigging weight [Row B]):	_____	lbs / kg
D. Radius from the crane's center-pin to the center of the furthest landing or lifting point:	_____	ft / m
E. Boom Angle _____ degrees	Boom length _____	feet / meters
F. Maximum Load Chart Capacity weight (360-degree capacity) as crane is configured:	_____	lbs / kg
If the weight in Row C is greater the Row F, DO NOT MAKE THE LIFT!		
G. If the weight in Row C is less than the weight in Row F, divide the weight in Row C by the weight in Row F and enter as a percentage:	_____	%
If the percentage in Row G is 75% or greater, DO NOT MAKE THE LIFT YET! THIS IS NOW A CRITICAL LIFT. Contact your SH&E representative or supervisor for a Critical Lift Checklist and procedures.		
If the percentage in Row F is less than 75%, or no unusual conditions have been identified, you may continue with the lift after this form has been signed by the following individuals:		
Comments:		
Crane Operator		
Print Name	Signature	Date
Manager (Program / Project)		
Print Name	Signature	Date

Americas

Critical Lift Plan

S3NA-310-FM3

Location: _____ Date of lift: _____

Load description: _____

Does this lift involve lifting personnel? ☐ Yes ☐ No

Lift description: _____

A. WEIGHT

1. Weight Empty (load or basket) _____ lbs
2. Weight of Headache Ball or block _____ lbs
3. Weight of Lifting Bar _____ lbs
4. Weight of Slings and Shackles _____ lbs
5. Weight of Jib _____ lbs
6. Weight of Headache Ball on Jib _____ lbs
7. Weight of Cable (Load Fall) _____ lbs
8. Allowance for Unaccounted Material in Equipment (10% of weight) _____ lbs
9. No. of people lifted x 250 _____ lbs
10. Other _____ lbs
- Total Weight _____ lbs

Source of Load Weight:

(Name Plate, Drawings, Calculated)

Weights Verified By:

B. JIB

Erected ☐ Stored ☐

1. Is Jib to be used? ☐ Yes ☐ No
2. Length of Jib _____
3. Angle of Jib _____
4. Rated Capacity of Jib (From Chart)

C. CRANE PLACEMENT

1. Any Deviation from Smooth, Solid Foundation in the Area?

2. Electrical Hazards in Area?

3. Obstacles or Obstructions to Lift or Swing?

4. Swing Direction and Degree (Boom Swing)?

D. CABLE

1. # of Parts of Cable: _____
2. Size of Cable: _____

E. SIZING OF SLINGS

1. Sling Selection
 - a. Type of Arrangement _____
 - b. # of Slings in Hook-up _____
 - c. Sling Length _____
 - d. Rated Capacity of Sling
2. Shackle Selection
 - a. Capacity (tons) _____
 - b. Shackle attached to load by: _____
 - c. Number of shackles _____

F. CRANE

1. Type of Crane _____
2. Crane Capacity _____ Tons
3. Lift Arrangement
 - a. Max Distance-Center of Load to center pin of crane _____ ft. / m.
 - b. Length of Boom _____ ft. / m.
 - c. Angle of Boom at pick-up _____ degrees
 - d. Angle of Boom at set _____ degrees
 - e. Rated capacity of crane under most severe lifting conditions (From Chart)
 1. Over Rear _____ lbs / kg
 2. Over Front _____ lbs / kg
 3. Over Side _____ lbs / kg
4. From chart – Rated capacity of the crane for the Lift
5. Max. Load on Crane _____ lbs.
6. Lift is within Crane's Rated Capacity _____

G. PRE-LIFT CHECKLIST

- | | YES | NO |
|--|---------------------------------|--------------------------|
| 1. Matting Acceptable | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Outriggers fully extended | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Crane in good condition | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Swing Room | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Head Room Checked | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Max. Counterweights used | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Tag line used | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Experienced Operator | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Experienced Signaler (Designated) | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Experienced Rigger | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Load Chart in Crane | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Communication method _____ | | |
| | Tested <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Wind / Weather Conditions: _____ | | |
| 14. Crane Inspected By: _____ | | |
| 15. Functional Test of Crane By: _____ | | |

SPECIAL INSTRUCTIONS OR RESTRICTIONS FOR CRANE, RIGGING, LIFT, ETC.

DIAGRAM CRANE AND LOAD PLACEMENT	DIAGRAM RIGGING CONFIGURATION
---	--------------------------------------

Rigging Supervisor:	Signature:	Date:
AECOM SH&E Manager:	Signature:	Date:
Crane Operator:	Signature:	Date:
Signal Person:	Signature:	Date:
Plan Checked By:	Signature:	Date:
Manager (program / project):	Signature:	Date:
	Signature:	Date:
	Signature:	Date:
	Signature:	Date:
	Signature:	Date:

Americas

Daily Crane Inspection

S3NA-310-FM4

Operations Daily Memo

[illegible]

Shift: _____ Date: _____

Start Hour Meter: **No. of Loads:**

End Hour Meter:

Adjustments or Repairs Needed:

[illegible]

Operator:

Safety Inspection

[illegible]

Cranes Only

Load Charts/Operator Manual/Log Book	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drum/Winch Brakes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hoist/Boom Wire Rope and Sheaves	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hooks and Safety Latches	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Load and Boom Angle Indicators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anti-Two Block Device	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drum Rotation Indicators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Boom/Pins and Keepers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hydraulic Controls/Cylinder Leaks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outrigger Beams/Pads	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Americas

Monthly Crane Inspection

S3NA-310-FM5

Inspection Period:		Crane Unit #:		Capacity:		Hour Meter:	
Date:		Manufacturer:				Model:	
Crane Type:		<input type="checkbox"/> Crawler <input type="checkbox"/> Truck <input type="checkbox"/> Hydraulic				Location:	
Block Codes: ✓ Satisfactory X Not Satisfactory — Not Applicable							
GENERAL CHECKS				HYDRAULIC BOOM			
1. <input type="checkbox"/> Operators Manual/Configuration Drawings 2. <input type="checkbox"/> Hand Signals Posted 3. <input type="checkbox"/> Anti-Two-Block Warning Signs 4. <input type="checkbox"/> High Voltage Warning Sign 5. <input type="checkbox"/> Capacity Chart in Cab 6. <input type="checkbox"/> Warning Horn Operational 7. <input type="checkbox"/> Fire Extinguisher (minimum 10BC, 5 LB) 8. <input type="checkbox"/> Boom Angle Indicator 9. <input type="checkbox"/> Backup Alarm 10. <input type="checkbox"/> Anti-Two-Block Device (Main) 11. <input type="checkbox"/> Anti-Two-Block Device (Auxiliary) 12. <input type="checkbox"/> Load-Moment Indicator (If required) 13. <input type="checkbox"/> Handholds and Steps 14. <input type="checkbox"/> Non-Skid Surfaces 15. <input type="checkbox"/> Catwalks and Handrails 16. <input type="checkbox"/> Directional Signals 17. <input type="checkbox"/> Head, Tail, Brake Lights 18. <input type="checkbox"/> Housekeeping 19. <input type="checkbox"/> Lubrication, Fluid Levels, and Fluid Condition 20. <input type="checkbox"/> Overhead Protection 21. <input type="checkbox"/> Window Glass 22. <input type="checkbox"/> Log Book 23. <input type="checkbox"/> Drum Rotation Indicators 24. <input type="checkbox"/> Swing Radius Barricades				1. <input type="checkbox"/> Check operation by fully extending and retracting 2. <input type="checkbox"/> Check for twists and bends by viewing from over top of boom as it is being extended 3. <input type="checkbox"/> Check for bends, fully extended, view from side 4. <input type="checkbox"/> Check welds and check for cracks 5. <input type="checkbox"/> Check boom pivot shaft and keepers 6. <input type="checkbox"/> Check boom hoist cylinders and pins 7. <input type="checkbox"/> Check boom extension cables and sheaves 8. <input type="checkbox"/> Check boom point sheaves 9. <input type="checkbox"/> Check wear pads and adjustment			
				GANTRY/BACK HITCH/COUNTERWEIGHT			
				1. <input type="checkbox"/> Check welds and check for cracks 2. <input type="checkbox"/> Check sheaves, shafts, pins, and keepers 3. <input type="checkbox"/> Check counterweight bolts/retainers			
				WIRE ROPE AND PENDANTS			
				1. <input type="checkbox"/> Use <i>Monthly Wire Rope / Hook Inspection (S3NA-310-FM6)</i> 2. <input type="checkbox"/> Check condition of main hoist rope 3. <input type="checkbox"/> Check condition of auxiliary hoist rope 4. <input type="checkbox"/> Check condition of boom hoist rope 5. <input type="checkbox"/> Check condition of pendants, especially at sockets 6. <input type="checkbox"/> Check all hoisting rope dead ends, clamps and sockets.			
CRANE CONFIGURATION COMPLIES WITH MANUFACTURER'S DESIGN							
1. <input type="checkbox"/> Counterweights 2. <input type="checkbox"/> Gantry Position 3. <input type="checkbox"/> Mast Position 4. <input type="checkbox"/> Boom Hoist Reeving 5. <input type="checkbox"/> Maximum Boom Not Exceeded 6. <input type="checkbox"/> Maximum Jib Not Exceeded							
LATTICE BOOM/JIB				LOAD BLOCK AND OVERHAUL BALL			
1. <input type="checkbox"/> Check integrity of boom stops 2. <input type="checkbox"/> Check boom hoist kickout 3. <input type="checkbox"/> Check boom for alignment with revolving frame, cords, and lacing for damage or improper and undocumented repairs 4. <input type="checkbox"/> Check for cracked welds 5. <input type="checkbox"/> Check jib for alignment, damage, or improper and undocumented repairs 6. <input type="checkbox"/> Check jib backstop NOTE: Cable-type belly slings do not comply with 1926.550 7. <input type="checkbox"/> Check all boom and jib connecting pins and locks 8. <input type="checkbox"/> Check point sheaves and wire rope guides 9. <input type="checkbox"/> Check jib suspension				1. <input type="checkbox"/> Check main hook for cracks, bending, and safety latch 2. <input type="checkbox"/> Check auxiliary hook for cracks, bending, and safety latch 3. <input type="checkbox"/> Check sheaves 4. <input type="checkbox"/> N.D.T. main hook 5. <input type="checkbox"/> N.D.T. auxiliary hook			
				The mobile, hydraulic, and crawler crane inspector and operator should be familiar with the requirements of (list regulations and standards applicable to the jurisdiction):			

HOIST AND SWING MACHINERY	CARRIER
1. <input type="checkbox"/> Hydraulic Main Hoist 2. <input type="checkbox"/> Hydraulic Auxiliary Hoist 3. <input type="checkbox"/> Hydraulic Swing and Brake 4. <input type="checkbox"/> Main Hoist Clutch 5. <input type="checkbox"/> Main Hoist Brake 6. <input type="checkbox"/> Auxiliary Hoist Clutch 7. <input type="checkbox"/> Auxiliary Hoist Brake 8. <input type="checkbox"/> Third Drum Frictions 9. <input type="checkbox"/> Boom Hoist Clutch and Brake 10. <input type="checkbox"/> Boom Hoist Dog 11. <input type="checkbox"/> Power-Down Drive and Operation 12. <input type="checkbox"/> Gear and Drive Guards	1. <input type="checkbox"/> Outrigger Operation and Controls 2. <input type="checkbox"/> Outrigger Structure and Pads 3. <input type="checkbox"/> Frame, Cracks, and Welds 4. <input type="checkbox"/> Wheel Lug Nuts 5. <input type="checkbox"/> Tire Condition and Pressure 6. <input type="checkbox"/> Cab Seat, Gages, Horn 7. <input type="checkbox"/> Engine Operation and Mounts 8. <input type="checkbox"/> Radiator, Hoses, Belts 9. <input type="checkbox"/> Air Cleaner 10. <input type="checkbox"/> Alternator, Batteries 11. <input type="checkbox"/> Service Brakes 12. <input type="checkbox"/> Parking, Safety Brakes 13. <input type="checkbox"/> Steering Apparatus 14. <input type="checkbox"/> Check for Damaged or Blistered Brake Hoses
UPPER ENGINE, TRANSMISSION, AND TC	LOAD ENHANCEMENT DEVICE
1. <input type="checkbox"/> Engine Operation 2. <input type="checkbox"/> Belts, Radiator, Hoses 3. <input type="checkbox"/> Air Cleaner 4. <input type="checkbox"/> Air Compressor 5. <input type="checkbox"/> Transmission or Converter 6. <input type="checkbox"/> Electrical System, Batteries 7. <input type="checkbox"/> Fluid Leaks	1. <input type="checkbox"/> Ringer Type 2. <input type="checkbox"/> Skyhorse Type 3. <input type="checkbox"/> Linkbelt Heavy Lift Type 4. <input type="checkbox"/> Configuration Complies with Manufactures Design 5. <input type="checkbox"/> Integrity of Device 6. <input type="checkbox"/> Other _____
CARBODY AND CRAWLERS	MISCELLANEOUS CHECKS
1. <input type="checkbox"/> Check for Structural Cracks 2. <input type="checkbox"/> Drive Chains 3. <input type="checkbox"/> Drive Motors 4. <input type="checkbox"/> Lower Jaw Clutch Operation 5. <input type="checkbox"/> Travel Brakes and Dogs 6. <input type="checkbox"/> Crawler Extension Mechanism	1. <input type="checkbox"/> 2. <input type="checkbox"/> 3. <input type="checkbox"/> 4. <input type="checkbox"/> 5. <input type="checkbox"/>

REMARKS:

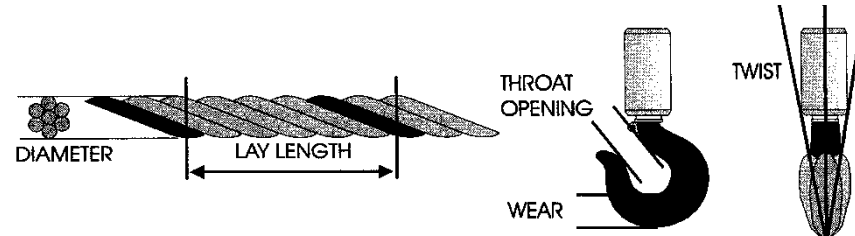
Inspected by: _____	Signature _____	DATE: _____
Repaired by: _____	Signature _____	DATE: _____

Americas

Monthly Wire Rope & Hook Inspection

S3NA-310-FM6

ROPE CLASSIFICATION:		MFG. BREAKING STRENGTH:	SWL (SAFE WORKING LOAD):		OWNER IF OTHER THAN AECOM:
HOOK MANUFACTURE:	I.D. NUMBER:	NDT RESULTS (NON-DESTRUCTIVE):	UNIT NUMBER:		PROJECT NUMBER:

[illegible]

Americas

Monthly Synthetic Sling Inspection

S3AM-310-FM7

Location: _____ Inspector: _____ Date: _____
print

Sling ID	Rated Load Capacity Label Absent / illegible <small>(enter capacity and units)</small>	Acid Burns	Melting or Charring	Snags	Punctures	Tears or Cuts	Broken or Worn Stitches	Distorted or Worn Fittings	Chemical or UV Damage	Worn Sling Cover	Return to Service or Remove	Comments
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
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	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	

NOTE: Defective slings must be removed from service and permanently altered to prevent reuse.

Inspector: _____
Signature

Americas

Monthly Shackle Inspection

S3NA-310-FM8

Location: _____ Inspector: _____ Date: _____
print

Shackle ID	Pin & Shackle Manufacturer / Engineer Stamp Absent / illegible (enter manufacturer or engineer)		Rated Load Capacity Absent / illegible (enter capacity and units)		Pin		Shackle		Pin Not Fully Seated	Other (cracks, nicks, modifications, painted, etc.)	Return to Service or Remove	Comments
					Wear >10%	Bend	Wear >10%	Change in Shape				
	YES / NO		YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
	YES / NO		YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
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	YES / NO		YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	
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	YES / NO		YES / NO		YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	YES / NO	Return / Remove	

NOTE: Deficient shackles must be removed from service.

Inspector: _____
Signature

Americas

Monthly Rigging Inspection

S3NA-310-FM9

Sling Choker Chain- Lifting Beam Number	WIRE ROPE	No. of Damaged Wires	Burn Marks	Corrosion	Fittings Damaged	Bird Caging	SYNTHETIC	No. of "Red" Threads Showing	Burn or Chemical Mark	Label Readable	Fittings Damaged	Heat Damage	CHAIN	Corrosion	Links Worn or Cracked	Label Readable	Heat Damage	LIFTING BEAM	Certified	Modifications w/o Mfg. Approval	Load Capacity Visible	INSPECTION RESULTS	PASS	FAIL- destroy sling/choker
	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Block Codes

X=Yes; ✓=No; NA = Not Applicable

Monthly Rigging Inspection (S3NA-310-FM9)

Revision 3 March 1, 2016

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Americas

Boom Truck Checklist

S3NA-310-FM10

Employees working with boom truck operators shall review the boom truck hazard checklist to heighten awareness while working on and around the boom truck. Manufacturer provided access points on boom trucks are the ONLY approved access and egress on/off the bed of the truck.

The operator is in control of ALL operations associated with this equipment. The Operator will ensure the following items have been performed and reviewed, and signed by all parties working with the boom truck PRIOR TO THE START OF OPERATIONS. The completed form will be returned to the safety department at the end of each shift.

Date:	Operator:	Location:
Activity A Task Hazard Assessment (THA) must be developed prior to any lifting activities being performed that involve the use of the boom truck.		Check Boxes
Operator's pre-shift inspection		<input type="checkbox"/>
Complete the Project Lift Classification Checklist (attached to this form)		<input type="checkbox"/>
Chock wheels when parking		<input type="checkbox"/>
Ensure adequate lighting is provided for night operations		<input type="checkbox"/>
The weight of the load to be lifted is within the load capacity of the boom truck		<input type="checkbox"/>
Ensure that all rigging is adequate and within the rated capacity for the load to be lifted		<input type="checkbox"/>
Only authorized personnel permitted within swing radius of the boom		<input type="checkbox"/>
Verify workers, materials, and other equipment are clear of ALL boom truck devices and movement PRIOR to manipulation, operation, and/or movement of the equipment		<input type="checkbox"/>
Alert coworkers before extending outriggers at the beginning of a task		<input type="checkbox"/>
Complete survey to ensure the boom truck cannot contact overhead power lines		<input type="checkbox"/>
Use pads under outriggers when necessary.		<input type="checkbox"/>
Ensure ground is stable and free of underground utilities.		<input type="checkbox"/>
Watch for swinging of headache ball when unlatching hook from D-ring		<input type="checkbox"/>
Inspect shackles and chokers before attaching to hook		<input type="checkbox"/>
Boom truck bed access is available and in good condition (permanent or temporary ladder)		<input type="checkbox"/>
Review access/egress with personnel assigned to work on Boom Truck		<input type="checkbox"/>
Never use outriggers for access or egress		<input type="checkbox"/>
Have two people move boom cradle out of way		<input type="checkbox"/>
When loading and unloading boom trucks, check that the following are observed:		
Always use tag lines		<input type="checkbox"/>
Give clear hand signals		<input type="checkbox"/>
Do not walk under a suspended load.		<input type="checkbox"/>
Secure material transported on boom truck.		<input type="checkbox"/>
Stay clear of boom's swing radius.		<input type="checkbox"/>
After task, notify all personnel before retracting outriggers.		<input type="checkbox"/>
Return rigging, outrigger pads, tools, boom cradle, and hook to proper locations.		<input type="checkbox"/>

Attendees Signatures	
Print Name	Signature

Americas

Personnel Platform Lifting

S3NA-310-FM11

Project Name:	Project/Contract Number:
Manager / Supervisor:	Date:
Competent Person:	Crane Operator:
Crane Model No:	Crane Manufacturer:
Crane Capacity:	Hours:

1. Job description (including estimated time required): _____

2. Basket needed: _____ A. Height from ground in (approx.): _____ feet / meters

3. Location and load

A. Expected load in pounds:

i. People at 250 lbs (113 kg) each:	_____ lbs / kg	iv. Weight of basket and rigging:	_____ lbs / kg
ii. Weight of tools and material:	_____ lbs / kg	v. Total weight:	_____ lbs / kg
iii. Subtotal weight:	_____ lbs / kg		

4. Pre-Lift

A. Test load in pounds (1.5 times Item 4.C.iii [subtotal weight above]): _____ lbs / kg

B. Crane operator to check boom angle and radius for capacity

i. Crane capacity	_____ lbs / kg	iii. Item 3.A.v (total weight):	_____ lbs / kg
ii. Item 4.B.i divided by 2	_____ lbs / kg	iv. If Item 4.B.iii is larger than Item 4.B.ii, this crane	
iii. Item 3.A.v (total weight)	_____ lbs / kg	may not be used.	

C. Completed full-cycle test lift (1.5 times Item 3.A.iii [subtotal weight]). Test load in pounds: _____ lbs / kg

Competent Person Name: _____ Signature: _____

GENERAL REQUIREMENTS

- | | |
|--|--|
| 1. SH&E representative or Competent Person has reviewed and accepted work platform use | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. Task Hazards Assessment completed and attached..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. Critical Lift Checklist completed and attached..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. Area barricaded or otherwise secured from unauthorized personnel entrance..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |

CRANE REQUIREMENTS

- | | |
|--|--|
| 1. Load lines are capable of supporting 5 times maximum intended load (10 times for rotation-resistant wire rope) | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. Total weight of loaded platform and rigging does not exceed 50 percent of rated capacity per boom angle & radius | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. Crane does not have live boom; load line hoist is regulated with a device other than the hoist brake that regulates lowering speed..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. Crane has a positive acting anti-two-block device that deactivates hoisting action..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 5. Boom angle indicator is functional and readily visible to the operator..... | <input type="checkbox"/> Yes <input type="checkbox"/> No |

PLATFORM LOADING

- | | |
|--|--|
| 1. The platform is not loaded in excess of its rated capacity | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. The number of employees does not exceed the number required for the work to be performed | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. The platform is not used to hoist tools or materials except for those necessary for employees to perform the work | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. Personnel, tools, and materials are evenly distributed within the platform | <input type="checkbox"/> Yes <input type="checkbox"/> No |

RIGGING REQUIREMENTS	
1.	Wire rope, shackles, and other rigging hardware are capable of supporting 5 times the maximum intended load <input type="checkbox"/> Yes <input type="checkbox"/> No
2.	Lifting bridles are four legs of equal length connected by common ring <input type="checkbox"/> Yes <input type="checkbox"/> No
3.	All eyes in wire rope slings are fabricated with thimbles <input type="checkbox"/> Yes <input type="checkbox"/> No
4.	Shackle bolts are secured against displacement (pinned or moused) <input type="checkbox"/> Yes <input type="checkbox"/> No
5.	Safety line passes through the eye of each bridle leg and is attached above the headache ball or to the crane hook ... <input type="checkbox"/> Yes <input type="checkbox"/> No
6.	Hook throat opening has been closed by pinning, bolting, or mousing safety latch <input type="checkbox"/> Yes <input type="checkbox"/> No
7.	Rigging is dedicated for platform use and is not used for any other purpose when not hoisting personnel <input type="checkbox"/> Yes <input type="checkbox"/> No
PLATFORM REQUIREMENTS	
1.	Platform is posted with its weight and rated load capacity or maximum intended load <input type="checkbox"/> Yes <input type="checkbox"/> No
2.	A grab rail is installed inside the entire perimeter of the platform <input type="checkbox"/> Yes <input type="checkbox"/> No
3.	Access gates, if installed, do not swing outward and have a device to prevent accidental opening <input type="checkbox"/> Yes <input type="checkbox"/> No
4.	In addition to hard hats, employees are afforded overhead protection by the platform when exposed to falling objects <input type="checkbox"/> Yes <input type="checkbox"/> No
5.	All edges exposed to employee contact are smoothed to prevent injury from punctures or lacerations <input type="checkbox"/> Yes <input type="checkbox"/> No
PROOF-TESTING, TRIAL LIFT, AND INSPECTION	
1.	After proof testing, the platform has been inspected for deficiencies <input type="checkbox"/> Yes <input type="checkbox"/> No
2.	Loaded at least to anticipated weight, a trial lift from the ground to each location the platform is to be hoisted and positioned has been conducted (may be done concurrently with proof testing and must be repeated if the crane is repositioned). <input type="checkbox"/> Yes <input type="checkbox"/> No
3.	After trial lift and prior to hoisting employees, an inspection has been made to ensure that the hoist rope is free of kinks, that multiple lines (if used) are not twisted around each other, that the primary attachment is centered over the platform, and that the load rope is properly stated on drums and sheaves. <input type="checkbox"/> Yes <input type="checkbox"/> No
OTHER	
1.	Tag lines are attached and ready for use, unless it is determined the use of tag lines creates an unsafe condition <input type="checkbox"/> Yes <input type="checkbox"/> No
2.	A pre-lift meeting with all affected employees has been conducted <input type="checkbox"/> Yes <input type="checkbox"/> No
3.	There is no adverse weather condition, winds < 15 mph, and no electrical storm activity or heavy rain <input type="checkbox"/> Yes <input type="checkbox"/> No
4.	Employees will remain in continuous sight of and in communication with the operator or signal person. If radios are used, they have been tested <input type="checkbox"/> Yes <input type="checkbox"/> No
5.	Employees have been tied off with full body harness above the headache ball, or to the load block <input type="checkbox"/> Yes <input type="checkbox"/> No
Remarks:	

Pre-lift Meeting Name and Signatures

Manager / Supervisor	Signature	
SH&E Representative	Signature	
Crane operator	Signature	
Competent person	Signature	
Lifted personnel	Signature	
	Signature	
	Signature	
	Signature	
	Signature	
	Signature	

If the crane must be relocated, then a new Personnel Platform Pre-Lift Form is required.

Americas

Assembly – Disassembly Procedure

S3NA-310-FM12

Location	_____	Date	_____
Crane Owner	_____	Manufacturer	_____
Model	_____	Serial Number	_____
Name of Competent- Qualified Technician/Supervisor (A/D Supervisor)	_____	Competent-Qualified Technician/Supervisor (A/D Supervisor) Employed By:	_____
Name of Qualified Rigger	_____	Qualified Rigger Employed By:	_____
Name of Qualified Crane Signalman:	_____	Qualified Crane Signalman Employed By:	_____

Attach all competent/qualified personnel's documentation/qualifications to this form. These documents are required to be placed in the project's site equipment file associated with the above listed crane and serial number.

Crane manufacture's procedures for assemble/disassembly (including attachments) must be followed. NOTE: If the manufacture's procedures are not used or followed, the following procedures must be met:

- Prevent unintended dangerous movement, and prevent collapse, of any part of the equipment.
- Provide adequate support and stability of all parts of the equipment.
- Position employees involved in the assembly/disassembly operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized
- A qualified person must develop the assembly/disassembly procedures.

Assembly/disassembly competent/qualified personnel must review the following with all crewmembers prior to start of any work. All crewmembers need to sign this document, which will verify their attendance during the pre-job meeting and directions are understood.

- Explain and review crewmember's task for assembly/disassembly of the crane/attachment.
- Discuss the associated hazards for the tasks crewmember will be performing.
- Review hazardous positions/locations and pinch points.
- Crew members must inform the person in charge (PIC) and the crane operator if it becomes necessary for them to enter an area out of the operators view (in, on, or under the equipment or load).
- While a crewmember is in a location and out of the operators view, the machine is not to be moved, unless directed by the PIC (competent-qualified A/D person), clearing that the crewmember is in a safe position.
- When assembling/disassembling crane boom or attachments, no one is allowed under the boom at any time. NOTE: Any exemptions to this rule shall comply with regulatory requirements.
- During all phases of assembly/disassembly, rated capacity limits for loads imposed on the equipment, [equipment components (including rigging) lifting lugs and equipment accessories], must not be exceeded during the process.
- The following specific hazards must be addressed/discussed:
 1. Site and ground bearing conditions to support the equipment (slope, compaction, firmness)
 2. Blocking/cribbing (material, size, proper placement under loads, boom, etc.)
 3. Verify assist crane(s) loads and capacities for working radius used during assembly/disassembly process

Definitions

S3NA-310-ATT1

1. Altered means any change to the original manufacturers design configuration, such as replacement of weight-handling equipment parts and components with parts or components not identical to the original (i.e., change in material, dimensions, or design configuration; the addition of parts or components not previously a part of the equipment; the removal of components previously a part of the load handling equipment; rearrangement of original parts or components).
2. Anti-two-block device is activated to prevent two-blocking, and disengages the particular function whose movement is causing the two-blocking.
3. Articulating crane is a crane whose boom consists of a series of folding, pin-connected structural members, typically manipulated to extend or retract by power from hydraulic cylinders.
4. Assembly/Disassembly means the assembly and/or disassembly of equipment covered under this procedure.
5. Assist crane is a crane used to assist in assembling or disassembling a crane.
6. Attachments are any devices that expand the range of tasks that can be done by the equipment.
7. Audible signal means a signal made by a distinct sound or series of sounds.
8. Boom angle is the angle between the horizontal and the centerline of boom base and inserts, and is an indication of operating radius.
9. Boom point elevation is the vertical distance from the ground to the centerline of the boom point shaft.
10. Blocking or cribbing is wood or other material used to support equipment or a component and distribute loads to the ground.
11. Boatswain's chair is a single-point adjustable suspension scaffold consisting of a seat or sling designed to support one employee in a sitting position.
12. Bogie means travel bogie, and is defined as two or more axles mounted in tandem in a frame so as to divide the load between the axles, and permit vertical oscillation of the wheels.
13. Boom, other than tower crane, means an inclined spar, strut, or other long structural member that supports the upper hoisting tackle on a crane or derrick.
14. Boom – tower cranes means that if the principal horizontal structure is fixed, it is a jib, or, if it is moveable, it is referred to as a boom.
15. Boom angle indicator is the angle between the horizontal and the centerline of the boom base and inserts, and is an indication of operating radius.
16. Boom–hoist-limiting device includes boom hoist disengaging device, boom hoist shut-off, boom hoist disconnect, boom hoist hydraulic relief, boom hoist kick-outs, automatic boom stop device, or derricking limiter.
17. Boom length indicator indicates the length of the permanent part of the boom (such as ruled markings on the boom) or, as in some computerized systems, the length of the boom with extensions/attachments.

18. Boom stop includes belly straps with struts/standoff boom stops, telescoping boom stops, attachment boom stops, and backstops. These devices restrict the boom from moving above a certain maximum angle and toppling over backward.
19. Boom suspension system is a system of pendants, running ropes, sheaves, and other hardware that supports the boom tip and controls the boom angle.
20. Bridge is that part of a gantry or overhead crane that carries the trolley(s).
21. Builder means an employee builder/constructor of equipment.
22. Cathead is a spool shaped attachment on a winch around which rope is wound for hoisting and pulling.
23. Center of gravity is the point in the object around which its weight is evenly distributed.
24. Certified Welder is a welder who meets nationally recognized certification requirements applicable to the task being performed.
25. Climbing means the process in which a tower crane is raised to a new working height.
26. Top climbing is adding tower sections to the top of the crane.
27. Inside climbing is a system in which the entire crane is raised inside the structure.
28. Come-a-long means a mechanical device typically consisting of a chain or cable attached at each end that is used to facilitate movement of materials through leverage.
29. Competent person is one who is capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.
30. Controlled-load lowering means lowering a load by means of a mechanical hoist drum device that allows a hoisted load to be lowered with maximum control using the gear train or hydraulic components of the hoist mechanism. Controlled-load lowering requires the use of the hoist drive motor, rather than the load hoist brake, to lower the load.
31. Controlling entity means a prime contractor, general contractor, construction manager, or any other legal entity that has the overall planning, quality, and completion responsibility for the construction of the project.
32. Counterweight means a weight used to supplement the equipment weight in providing stability for lifting loads by counterbalancing those loads.
33. Crane/derrick includes all equipment covered by *S3NA-310-PR1 Cranes & Lifting Devices*.
34. Cribbing is a system of timber, arranged in a rectangular pattern, used to support and distribute the weight of equipment.
35. Crawler crane means equipment that has a type of base mounting which incorporates a continuous belt of sprocket-driven track.
36. Critical Lift identifies loads classified as requiring a formal, written plan. A critical lift plan is defined as a non-routine crane lift requiring detailed planning and additional or unusual safety precautions. Critical lifts include lifts made when the load is greater than 75 percent of the rated capacity of the crane in the configuration that the lift will be made; lifts that require the load to be lifted, swung, or placed out of the operator's view; lifts made with more than one crane or hoisting device; lifts involving non-routine or

technically difficult rigging arrangements; lifts of long lead time permanent materials; lifts that involve lifting loads over structures or equipment; lifts taking place in a confined or limited access areas; hoisting personnel with a crane or derrick; or any lift which the lift supervisor, operator, or other management personnel believes should be considered critical.

37. Crossover points are locations on a wire rope that are spooled on a drum where one layer of rope climbs up on and crosses over the previous layer.
38. Dedicated channel means a line of communication assigned by the employer who controls the communication system to only one signal person and crane/derrick, or to a coordinated group of cranes/derricks/signal person(s).
39. Dedicated pile-driver is a machine that is designed to function exclusively as a pile-driver; hoisting the material and pile-driving it.
40. Dedicated spotter (power lines) must meet the requirement of this procedure (signal person qualifications), and the sole responsibility is to watch the separation between the power line and the equipment, load line, and load (including rigging and lifting accessories), and ensure through communication with the operator that the applicable minimum approach distance is not breached.
41. Deficiency is the state of being deficient; inadequacy; failure; imperfection; defect.
42. Derrick is a lifting device consisting of a mast secured at the top by guys or braces and, used with a hoisting mechanism and rigging, with or without a boom.
43. Dismantling includes partial dismantling (i.e., shorten a boom or substitute a different component).
44. Dragline is a bucket attachment for a crane that excavates by the crane drawing the bucket towards itself with a cable.
45. Duty cycle includes operations involving repetitive pick and swing, such as with a dragline, grapple, or clamshell; such operations are conducted primarily for production, as opposed to placement.
46. Drum rotation indicator means a device on a crane or hoist that indicates in which direction and at what relative speed a particular hoist drum is turning.
47. Electrical contact occurs when a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.
48. Employer-made equipment means floating cranes/derricks designed and built by an employer for the employer's own use.
49. Encroachment is where any part of the crane, load line, or load (including rigging and lifting accessories) breaches a minimum clearance distance required to be maintained from a power line.
50. Equipment criteria mean instructions, recommendation, limitations, and specifications.
51. Fall-protection equipment means guardrail systems, safety net systems, personal fall arrest systems, positioning device systems, or fall restraint systems.
52. Fall restraint system means a fall protection system that prevents the user from falling any distance, either by a body belt or body harness, along with an anchorage,

connectors, and other necessary equipment. Other components typically include a lanyard, and may also include a lifeline and other devices.

53. Fall zone means the area (including, but not limited to, the area directly beneath the load) in which it is reasonably foreseeable that partially or completely suspended material could fall in the event of an accident.
54. Fixed lead means pile-driving leads which are rigidly attached to a boom by horizontal struts extending from the leads to extended boom foot pins, thus providing a fixed triangular frame of boom, struts, and leads.
55. Flange points are points of contact between rope and drum flange where the rope changes layers.
56. Floating cranes/derricks are equipment designed by the manufacturer or employer for marine use by permanent attachment to a barge, pontoons, vessel, or other means of flotation.
57. Free fall (of the load line) means that only the brake is used to regulate the descent of the load line (drive mechanism is not used to drive the load down faster or retard its lowering).
58. Free surface effect is the uncontrolled transverse movement of liquids in compartments that reduce a vessel's transverse stability.
59. Gantry crane is a crane similar to an overhead crane except that a bridge is rigidly supported on two or more legs running on fixed rails or other runway.
60. Ground condition means the ability of the ground to support the equipment (including slope, compaction, and firmness).
61. Guy derrick is a fixed derrick consisting of a vertical mast capable of being rotated 360 degrees (but not continuous rotation) supported by guys, and a boom that is pivoted at the bottom and capable of moving in a vertical plane; a reeved rope between the head (top) of the mast and the boom harness (at the boom point) allows lifting and lowering of the boom, and a reeved rope from the boom point allows lifting and lowering of the load.
62. Hammerhead tower crane is a lifting machine arranged with a tower (mast), an upper structure that rotates, a horizontally-extended load jib (boom) with trolley, and a counterweight jib extending in the direction opposite of the load jib: neither jib is arranged for luffing. The trolley on the load jib traverses the length of the jib and contains the sheaves and accessory parts that make up the upper load block; the lower load block is suspended from the trolley.
63. Hoist means a mechanical device for lifting and lowering loads by winding rope onto or off of a drum.
64. Hoisting is the act of raising, lowering, or otherwise moving a load in the air with equipment covered by this procedure. In conformance with this procedure, "hoisting" can be done by means other than wire rope/hoist drum equipment.
65. Insulating link/device means an insulating device listed, labeled, or accepted by a nationally recognized testing laboratory. Jib stop, or jib backstop is the same type of device as a boom stop but is for a fixed or luffing jib.
66. Jib on hammerhead cranes is the horizontal structural member attached to the rotating superstructure of a crane and upon which the load trolley travels; on mobile cranes, an extension attached to the boom to provide added boom length for lifting specified loads.

An extension attached to the boom to provide added boom length for lifting specified loads. The jib may be in line with the boom, or offset to a fixed or various angles.

67. Land crane/derrick is equipment not originally designed by the manufacturer for marine use by permanent attachment to any means of floatation.
68. Lead is the device on a pile driver that maintains the hammer in position during the driving. A lead typically is made up of two vertical rails or guides, held together by a frame, in which the hammer moves vertically.
69. Lift supervisor is the person designated to be in charge of crane lifting; this may be the crane operator or an individual whose function it is to supervise lifting operations.
70. List means the angle of inclination about the longitudinal axis of a barge, pontoons, vessel, or other means of floatation.
71. Live boom is a boom that is lowered by free-fall rather than controlled boom lowering under power.
72. Load refers to the object(s) and the load-attaching equipment being hoisted, and/or the weight of the object(s).
73. Load block is an assembly of hook or shackle, swivel, pins, and frame.
74. Load moment indicator (or rated capacity) is a system that aids the equipment operator by sensing the overturning moment on the equipment; that is, load multiplied by radius. It compares this lifting condition to the equipment's rated capacity, and indicates to the operator the percentage of capacity at which the equipment is working. Lights, bells, or buzzers may be incorporated as a warning of an approaching overload condition.
75. Load moment limiter (or rated capacity) is a system that aids the equipment operator by sensing the overturning moment on the equipment (i.e., load multiplied by radius). It compares this lifting condition to the equipment's rated capacity, and when the rated capacity is reached, it shuts off power to those equipment functions that can increase the severity of loading on the equipment (e.g., hoisting, telescoping out, or luffing out). Typically, those functions that decrease the severity of loading on the equipment remain operational (e.g., lowering, telescoping in, or luffing in).
76. Load performance test is a test of a crane's performance, structural competence, and stability while lifting at a percentage of its rated load capacity.
77. Load ratings are crane ratings in pounds established by the manufacturer.
78. Locomotive crane means a crane mounted on a base or car equipped for travel on a railroad track.
79. Luffing is the act of raising or lowering the boom or jib of a crane.
80. Luffing jib limiting device is similar to a boom hoist limiting device, except that it limits the movement of the luffing jib.
81. Luffing jib crane is a type of jib on a crane that is pivoted at the jib foot and supported by luffing cables. The hoist rope usually passes over a sheave at the jib point, and the hook radius is changed by luffing, or changing the angle of inclination, of the jib. Rear pivoted luffing jibs are similar, but the pivot is towards the rear of the top of the tower, rather than at the jib foot.

82. Marine-hoisted personnel transfer device means a device, such as a “transfer net” (not to include boatswain’s chairs) that is designed to protect the employees being hoisted during a marine transfer, and to facilitate rapid entry into and exit from the device.
83. Marine worksite means a construction worksite located in, on, or immediately above the water.
84. Machine list is a side-to-side out of level, which affects the crane’s capacity rating, and is measured by the angle between horizontal and a line drawn through the centerline of the boom hinge pins.
85. Mobile crane is a lifting device incorporating a cable-suspended, latticed boom or hydraulic telescopic boom designed to be moved between operating locations by transport over the road.
86. Monorail is a single run of overhead track.
87. Moving point-to-point means the times during which an employee is in the process of going to or from a work station.
88. Multi-purpose machine means a machine that is designed to be configured in various ways, at least one of which allows it to hoist (by means of a winch or hook) and horizontally move a suspended load. For example, a machine that can rotate and can be configured with removable tongs (for use as a forklift) or with a winch pack, jib (with a hook at the end), or jib used in conjunction with a winch.
89. Multiple (tandem) crane lift is the use of two or more cranes/lifting devices to lift a load.
90. Non-conductive means that, because of the nature and condition of the materials used, and the conditions of use (including environmental conditions and condition of the material), the object in question has the property of not becoming energized (that is, it has high dielectric properties offering a high resistance to the passage of current under the conditions of use).
91. Not Portable means that an operator has a qualification that is not transferable to another job site or project, the qualification only meets the requirements of the location where the operator is employed by (and operating the equipment for) the employer that issued the qualification.
92. Operating radius is the horizontal distance from the crane’s rotation to the center of the vertical hoist line or load block/ball.
93. Operational aids are devices that assist the crane operator in the safe operation of the crane, including two-block warning devices, two-block prevention devices, load and load moment indicator devices, boom angle and radius indicators, boom and jib stops, boom hoist disengaging devices, limit switches, drum rotation indicators, etc. These load indication or moment devices do not replace the manufacturer-rated load capacity charts for boom angle and radius.
94. Operational controls are levers, switches, pedals and other devices for controlling equipment operation.
95. Operational performance test is a test, conducted without a test load, to determine the proper operation of a crane.
96. Operator is the person who is operating the equipment.

97. Outrigger is an extendable or fixed structural member(s) with one end attached to the base of a piece of equipment and the other end resting on floats on the ground: used to distribute loads in supporting equipment.
98. Outrigger float is the pedestal (or bearing pad) on which an outrigger beam is supported.
99. Overhead crane is a crane with a single- or multiple-girder moveable bridge or fixed hoisting mechanism, traveling on an overhead fixed runway structure.
100. Overhead and gantry cranes include overhead/bridge cranes, semi-gantry, cantilever gantry, wall cranes, storage bridge cranes, launching gantry cranes, and similar equipment, irrespective of whether it travels on tracks, wheels, or other means.
101. Pendants includes both wire and bar types. Pendants are typically used in latticed boom crane systems to easily change the length of the boom suspension system without completely changing the rope on the drum when the boom length is increased or decreased.
 - a. *Wire type*: A fixed length of wire rope with mechanical fittings at both ends for pinning segments of wire rope together.
 - b. *Bar type*: Instead of wire rope, a bar is used.
102. Performance test is a test to determine the proper operation of a crane and the ability of the crane, to safely lift loads within its performance rating.
103. Personal fall arrest system is a system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, and a body harness, and may include a lanyard, deceleration device, lifeline, or suitable combination of these.
104. Pillar crane is a fixed crane consisting of a vertical member, held in position at its base to resist overturning moment, and normally with a constant-radius revolving boom supported at the outer end by a tension member.
105. Portable means any operator with a certification that is usable for other job sites or projects, and meets the requirements of paragraph (a) of this procedure with respect to that operator.
106. Portal Crane is a type of crane consisting of a rotating upper structure, hoist machinery, and boom mounted on top of a structural gantry that may be fixed in one location, or have travel capability. The gantry legs or columns usually have portal openings in between to allow passage of traffic beneath the gantry.
107. Power-controlled lowering is a system or device in the power train, other than the load hoist brake, which can control the lowering rate of speed of the load hoist mechanism.
108. Power lines are electric transmission and distribution lines.
109. Procedures include, but are not limited to, instructions, diagrams, recommendations, warnings, specifications, protocols, and limitations.
110. Proximity alarm is a device that provides a warning of proximity to a power line that has been listed, labeled, or accepted by a Nationally Recognized Testing Laboratory.
111. Qualified evaluator (not a third party) is a person who, due to their independence and expertise, has demonstrated that they are competent in accurately assessing whether individuals meet the Qualification Requirements for a signal person.

112. Qualified evaluator (third party) is a person who, due to their independence and expertise, has demonstrated that they are competent in accurately assessing whether individuals meet the Qualification Requirements for a signal person.
113. Qualified person is a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.
114. Range control warning device is a device that can be set by an equipment operator to warn that the boom or jib tip is at a plane or multiple planes.
115. Rated capacity means the maximum working load permitted by the manufacturer under specified working conditions, typically including a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.
116. Reeving is a rope system in which the rope travels around drums and sheaves.
117. Reconfiguration is the addition or subtraction of boom, jib, and counterweight; or, for a fixed crane, a change in foundation.
118. Repetitive pickup points refers to, when operating on a short cycle operation, the rope being used on a single layer and being spooled repetitively over a short portion of the drum.
119. Running wire rope is a wire rope that moves over sheaves or drums.
120. Runway means a firm level surface designed, prepared, and designated as a path of travel for the weight and configuration of the crane being used to lift and travel with the crane's suspended platform. An existing surface may be used as long as it meets these criteria.
121. Saddle-jib is a type of jib on a tower crane supported by pendants. The jib is horizontal or nearly horizontal, non-luffing, and the load hook is suspended by a trolley that moves along the jib.
122. Sideboom crane is a track-type or wheel-type tractor with a boom mounted on the side of the tractor, used for lifting, lowering, or transporting a load suspended on the load hook. The boom or hook can be lifted or lowered in a vertical direction only.
123. Side loading is a load applied at an angle to the vertical plane of the boom.
124. Special hazard warnings mean warnings of site-specific hazards; for example, proximity of power lines.
125. Stability (floatation device) means the tendency of a barge, pontoons, vessel, or other means of floatation to return to an upright position after having been inclined by an external force.
126. Standby crane is a crane not in regular service, but which is used occasionally or intermittently as required.
127. Standing rope is a supporting rope that maintains a constant distance between two components connected by the rope.
128. Stiffleg derrick is a derrick similar to a guy derrick, except that the mast is supported or held in place by two or more stiff members (stifflegs) capable of resisting either tensile or compressive forces. Sills are generally provided to connect the lower ends of the stifflegs to the foot of the mast.

129. Supporting materials include blocking, mats, cribbing, marsh buggies (in marshes/wetland), or similar supporting materials or devices.
130. Swinger mechanism is the device that rotates a derrick mast.
131. Swinging (hanging) lead is a pile-driving lead suspended from an extended boom pint sheave pin at the top of the boom. The bottom points of the leads are positioned astride the pile location, the hammer is vertically above the top of the pile. Often the bottoms of the leads are pointed, and the weight of the pile leads and hammer force the bottom points into the ground, holding them in position.
132. Slewing is a rotation of the crane's upperworks.
133. Tagline means a rope (usually fiber) attached to a lifted load for purposes of controlling load spinning and pendular motions, or used to stabilize a bucket or magnet during material-handling operations.
134. Tailing crane lift is a procedure sometimes used in erecting large-pressure vessels or structural elements in which one crane (lead crane) lifts the top of the load, and a second crane (tail crane), rigged to the bottom of the load, either secures the bottom of the load from movement, or assists in the horizontal positioning of the load.
135. Telescoping boom consists of a boom base from which one or more boom sections are telescoped for additional length.
136. Tender means an individual responsible for monitoring and communicating with a diver.
137. Tilt-up or tilt-down operation means raising/lowering a load from the horizontal to vertical, or vertical to horizontal.
138. Top running bridge is a bridge that travels over the top of a runway track.
139. Tower crane is a type of lifting structure that uses a vertical mast or tower to support a working boom (jib) in an elevated position. Loads are suspended from the working boom.
 - a. While the working boom may be of the fixed type (horizontal or angled) or have luffing capability, it can always rotate to swing loads, either by rotating on the top of the tower (top slewing) or by the rotation of the tower (bottom slewing).
 - b. The tower base may be fixed in one location or ballasted and moveable between locations.
140. Travel bogie (tower cranes) is an assembly of two or more axels arranged to permit vertical wheel displacement and equalize the loading on the wheels.
141. Trim means angle of inclination about the transverse axis of a barge, pontoons, vessel, or other means of floatation.
142. Trolley is the unit that travels on bridge rails and supports the load block.
143. Two-blocking means a condition in which a component that is uppermost on the hoist line such as the load block, hook block, overhaul ball, or similar component, comes in contact with the boom tip, fixed upper block, or similar component. This binds the system, and continued application of power can cause failure of the hoist rope or other component.
144. Underhung crane (hoist) is a crane that is suspended from the bottom flange of a runway track or a single-track monorail system.

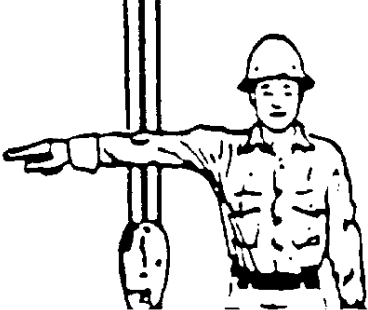
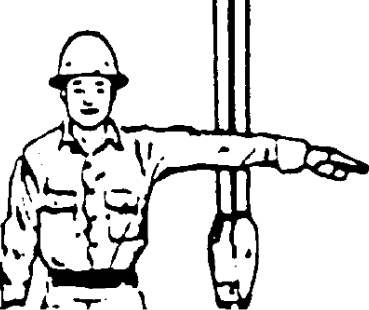
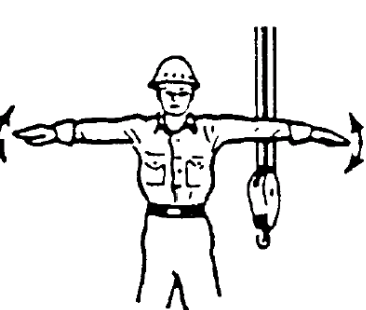
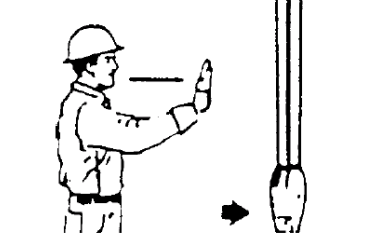

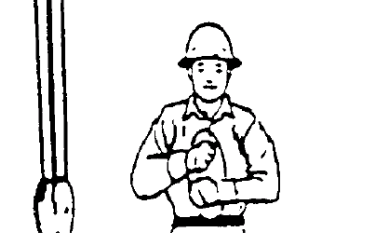
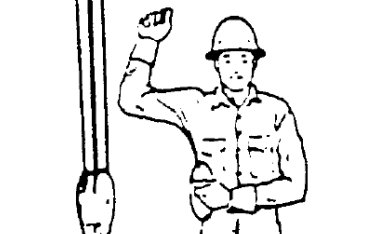


145. Upperworks mean the revolving frame of equipment on which the engine and operating machinery are mounted, along with the operator's cab. The counterweight is typically supported on the rear of the upper structure, and the boom or other front-end attachment is mounted on the front.
146. Wire rope is rope made of wire.
- a. *Rope Lay* signifies the direction of the rotation of the wire and strands in the rope. Rotation can either be clockwise or counterclockwise; the lay of the rope affects its flexibility and resistance to wear.
 - b. *Rope Lay Length* is the distance measured along a rope in which a strand makes one complete revolution around the rope axis.
 - c. *Right Lay Rope*: the wires in the strands are laid in one direction while strands in the rope are laid in the opposite direction. The result is that wire crown runs approximately parallel to the longitudinal axis of the rope. These ropes are stable, have good resistance to kinking and twisting, and are easy to handle. They are also able to withstand considerable crushing and distortion due to the short length of the exposed wires.
 - d. *Lang Lay Rope*: the wires in the strands and the strands in the ropes are laid in the same direction. The outer wires run diagonally across the rope and are exposed for longer lengths than regular lay rope. With the outer wires presenting greater wearing surfaces, lang lay ropes have greater resistance to abrasion. They are also flexible and possess greater resistance to fatigue. They are more liable to kinking and untwisting, and are not capable of withstanding the same abuse from distortion and crushing. Lang lay ropes should have both ends permanently fastened to prevent untwisting, and should not be recommended for use on single-part hoist lines, nor should they be used with swivel-end terminals.
 - e. *Alternate Lay Ropes* have three strands made with right lay and three with left lay. The six strands are then positioned in the finished rope so that the strands alternate.
 - f. *Rotation-Resistant Rope* is a wire rope consisting of an inner-lay of strand in one direction covered by a layer of strand laid in the opposite direction. This has the effect of counteracting torque by reducing the tendency of the finished rope to rotate.

Americas

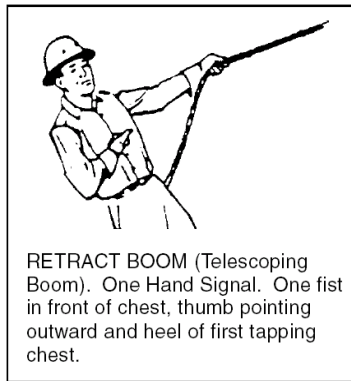
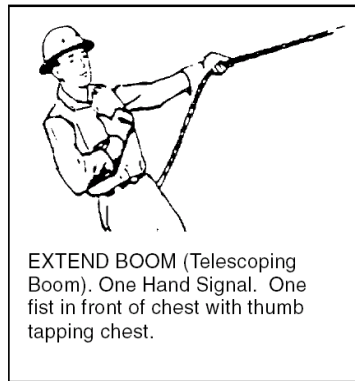
Standard Hand Signals

S3NA-310-ATT2

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

 <p>SWING. Arm extended, point with finger in direction of swing of boom.</p>	 <p>STOP. Arm extended, palm down, move arm back and forth horizontally.</p>	 <p>EMERGENCY STOP. Both arms extended, palms down, move arms back and forth horizontally.</p>
 <p>TRAVEL. Arm extended forward, hand open and slightly raised; make pushing motion in direction of travel.</p>	 <p>DOG EVERYTHING. Clasp hands in front of body.</p>	 <p>TRAVEL (Both Tracks). Use both fists in front of body, making a circular motion about each other, indicating direction of travel, forward or backward. (For land cranes only.)</p>
 <p>TRAVEL. (One Track). Lock the track on side indicated by raised first. Travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body. (For land cranes only.)</p>	 <p>EXTEND BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing outward.</p>	 <p>RETRACT BOOM (Telescoping Booms). Both fists in front of body with thumbs pointing toward each other.</p>

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS



<p>HOIST. With forearm vertical, forefinger pointing up, move hand in small horizontal circle.</p>	<p>LOWER. With arm extended downward, forefinger pointing down, move hand in small horizontal circle.</p>	<p>USE MAIN HOIST. Tap first on head; then use regular signals.</p>
<p>USE WHIPLINE (Auxiliary Hoist). Tap elbow with one hand; then use regular signals.</p>	<p>RAISE BOOM. Arm extended, fingers closed, thumb pointing upward.</p>	<p>LOWER BOOM. Arm extended, fingers closed, thumb pointing downward.</p>
<p>MOVE SLOWLY. Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example)</p>	<p>RAISE THE BOOM AND LOWER THE LOAD. With arm extended, thumb pointing up; flex fingers in and out as long as load movement is desired.</p>	<p>LOWER THE BOOM AND RAISE THE LOAD. With arm extended, thumb pointing down; flex fingers in and out as long as load movement is desired.</p>

Rigging

1.0 Rigging

- 1.1 This attachment to *S2NA-310-PR1 Cranes & Lifting Devices* further defines requirements related to rigging operations undertaken by Americas AECOM personnel. These requirements include the safe use and proper maintenance of rigging. For purposes of this attachment, the term "rigging" applies to all devices that are used in the lifting of objects. This includes, but is not limited to, wire rope and synthetic slings, rigging hardware, chain hoists, come-a-longs (manually lever operated hoists), below-the-hook lifting devices, lever chain, electric hoist, hooks, spreader and lifting beams, and blocks.
- 1.2 General
- 1.2.1 Allow only qualified employees to perform rigging tasks.
- 1.2.2 Know the safe working capacity of all rigging and equipment. Do not exceed the safe working capacity.
- The safe working load of rigging shall be based on a 5 to 1 safety factor of the minimum breaking strength.
 - Any rigging components used for hoisting personnel shall be based on a 10 to 1 safety factor.
 - Because many factors can impact load distribution when using more than one leg of rigging, each leg shall be adequately rated for the entire bearing load.
 - If permitted in the applicable jurisdiction, all hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use.
 - Hooks, clamps, or other lifting accessories custom designed for hoisting modular structures, panels or other similar materials shall be proof-tested to 125 percent of the rated load and marked with the safe working capacity prior to use.
- 1.2.3 Know the load weight, including the weight of the rigging.
- 1.2.4 Inspect all rigging before each use and as necessary during use; immediately remove any defective rigging from service. Record monthly inspections using:
- *S3NA-310-FM6 Monthly Wire Rope & Hook Inspection.*
 - *S3NA-310-FM7 Monthly Synthetic Sling Inspection.*
 - *S3NA-310-FM8 Monthly Shackle Inspection.*
 - *S3NA-310-FM9 Monthly Rigging Inspection.*
 - Or forms of equivalent content.
- 1.2.5 Deficient rigging (including, but not limited to wire rope, hooks, synthetic slings, chains and shackles) shall either be:
- Discarded and, as possible, modified to prevent reuse; or
 - Repaired or reshaped (e.g. restitched, annealing, etc.) as permitted by and in accordance with the manufacturer's specifications and applicable jurisdictional regulations. Additional requirements may be necessary (e.g. proof testing reshaped hooks, recertification of repaired slings, etc.).
- 1.2.6 When not in use, remove all rigging from the immediate work area so it does not present a hazard to employees and rigging is protected from damage.
- 1.2.7 Rigging (including, but not limited to wire rope, hooks, synthetic slings, chains and shackles)

- 1.2.8 shall be compatible with the environments where it is to be used (e.g., nylon slings are not to be used around torch cutting) and shall be used in accordance with manufacturer's recommendations.
- 1.2.9 Slack shall be taken out of the rigging prior to lifting the load.
- 1.2.10 Confirm hands, fingers, or limbs are not between rigging and load while the slack is being taken out of the rigging.
- 1.2.11 Use extreme caution to avoid shock loading, especially when temperatures are below freezing. Rigging that has been subjected to shock loading shall be removed from service until it has been properly inspected by a qualified person.
- 1.2.12 Always maintain safe working distances from energized power lines and equipment, as defined in *S3NA-322-PR1 Overhead Lines*.
- 1.2.13 Keep the load line plumb to maintain a stable load.
- 1.2.14 Use tag lines on all loads whenever feasible.
- 1.2.15 Use chocks, blocks, or other means to prevent movement of materials when unhooking a load.
- 1.2.16 Loads shall not be lowered directly onto rigging, but onto blocks to prevent damage and allow for rigging removal without causing abrasion.
- 1.2.17 Do not give signals to the crane operator, unless it is an emergency stop, or designated as signalman.
- 1.2.18 Keep hands off suspended loads whenever possible.
- 1.2.19 Do not stand or pass under a suspended load.
- 1.2.20 Verify that the straps, shackles, and the beam or overhead structure to which a come-a-long is secured is of adequate strength to support the weight of the load, plus gear. The upper hook shall be secured to prevent it from coming free of its support.
- 1.2.21 The supporting structure and the connection point shall have a load rating at least equal to that of the hoist.
- 1.2.22 Do not use scaffolding as a point of attachment for come-a-longs unless the scaffolding is specifically designate for that purpose.
- 1.2.23 Keep all portions of the human body from the area between the rigging and the load, and from between the rigging and the crane hook or hoist hook.
- 1.2.24 Never stand in line with or next to the leg(s) of a sling that is under tension.
- 1.2.25 Do not use synthetic rope or metal mesh slings as bridles on suspended personnel platforms.
- 1.3 Rigging Practices
 - 1.3.1 Do not use slings that appear to be damaged unless they are inspected and accepted as usable by a qualified person.
 - 1.3.2 Do not exceed the rated load of the sling.
 - 1.3.3 Shorten or adjust slings only by methods approved by the sling manufacturer.
 - 1.3.4 Do not shorten or lengthen slings by knotting or twisting.
 - 1.3.5 Hitch slings in a manner providing control of the load.
 - 1.3.6 Protect slings in contact with edges, corners, or protrusions with appropriate softeners or sleeves of a material of sufficient strength, thickness, and construction to prevent damage to the sling.
 - 1.3.7 Do not rest loads on the sling.
 - 1.3.8 Do not pull slings from under a load when the load is resting on the sling.
 - 1.3.9 Avoid twisting and kinking.

- 1.3.10 Be alert for possible snagging during lifting—with or without load.
- 1.3.11 Balance the load to prevent slippage in a basket hitch.
- 1.3.12 Rig the load to prevent the sling from slipping or sliding along the load, when using multiple basket or choker hitches.
- 1.3.13 Keep loads under control when using a basket hitch by ensuring the legs of the sling contain or support the load from the sides, above the center of gravity.
- 1.3.14 Do not drag slings on the floor or over an abrasive surface.
- 1.3.15 Make sure that the choke point in a choker hitch is only on the sling body, not on a splice or fitting.
- 1.3.16 Do not use an angle of choke less than 120 degrees in a choker hitch without reducing the rated load, as specified in American Society of Mechanical Engineers (ASME) B30.9-1.5.5.
- 1.3.17 Balance the load in a choker hitch to prevent edge overload.
- 1.3.18 Do not constrict, bunch, or pinch slings by the load, hook, or any fitting.
- 1.3.19 Center the load applied to the hook in the base (bowl) of the hook to prevent tip loading on the hook, unless the hook is designed for tip loading.
- 1.3.20 Do not use any object in the eye of a sling wider than one-third the length of the eye.
- 1.3.21 Do not allow sling and load to rotate when hand-tucked slings are used in a single-leg vertical-lift application. Take care to minimize sling rotation.
- 1.4 Chain Hoist and Come-a-Longs (manually lever operated hoists)
 - 1.4.1 Confirm the capacity of the chain hoist or come-a-long is clearly marked on the housing or handle of the equipment. Also confirm that this capacity is not exceeded.
 - 1.4.2 Mark the control actuator on come-a-longs to indicate the direction of the resultant motion.
 - 1.4.3 Inspect chain hoists before each use to confirm that they are safe. Inspect the lift chain, pinion, sheaves, and hooks for distortion and wear.
 - 1.4.4 Proof coil steel chain, also known as common or hardware chain, shall not be used for rigging or hoisting purposes.
 - 1.4.5 Wrought iron chains in constant use shall be annealed or normalized in accordance with the applicable jurisdictional requirements (e.g. California – at intervals not exceeding 6 months) and according to manufacturer's specifications.
 - 1.4.6 Inspect come-a-longs before each use to confirm that they are safe. Inspect the ratchet, pawl, chain, and hooks for distortion and wear.
 - 1.4.7 Confirm that the straps, shackles, and the beam or overhead structure to which a hoist is secured are of adequate strength to support the weight of the load plus gear. The upper hook shall be secured to prevent it from coming free of its support.
 - 1.4.8 Confirm that the supporting structure and the connection point has a load rating at least equal to that of the hoist.
 - 1.4.9 Confirm that the synthetic straps and slings have proper softening devices in place when used against sharp edges.
 - 1.4.10 Do not use any hoist that has defects or is in need of adjustment or repair, until repaired.
 - 1.4.11 Do not use scaffolding as a point of attachment for lifting devices such as tackle, chain falls, and come-a-longs, unless the scaffolding is specifically designed for that purpose.
 - 1.4.12 Testing guidelines are as follows:

- Operational Tests – Test all altered or repaired hoists, or hoists that have not been in use within the preceding 12 months, before being placed in service by, or under the direction of, a competent person to confirm compliance with this standard, including the following:
 - Check all functions of the hoist with the hoist suspended in the unloaded state, or nominally loaded, as necessary.
 - After the above test, apply a load of at least 50 pounds (23 kilograms) times the number of load-supporting parts of chain to the hoist in order to check proper load control.
- Load Test – Statically or dynamically load-test a hoist in which load-suspension parts have been altered, replaced, or repaired as follows:
 - A qualified person shall determine the need to load-test the hoist.
 - Prepare a written report of the test and place it on file.
 - The test load shall not be less than 100% of the rated load of the hoist, or more than 125% of the same, unless otherwise recommended by the manufacturer or a qualified person.
 - The replacement of load chain is excluded from this load test; however, make an operational test of the hoist in accordance with this standard prior to placing the hoist back in service.
 - A qualified person will approve test anchorages or suspensions for testing.

1.4.13 Inspection of Hoists

- A competent person will inspect all new, altered, or modified hoists prior to initial use.
- Do not use a hoist with a defect or in need of adjustment or repair until the hoist has been repaired.
- Daily, or before use if the hoist is not used daily, inspect the hoist to confirm there is no obvious damage to the hoist, loadline, or hooks. Inspections shall include operating mechanism, upper-limit device (if powered hoists), hoist braking system, hooks and latches, load line or chain, and load line reeving.
- Visual inspections (determined by service application) shall be performed and documented by a competent person. All operating parts of the hoist shall be inspected for wear, loose fasteners, corrosion, cracks, or distortion. ASME B30.16 shall be reviewed to confirm compliance.
- The inspector shall use a checklist to confirm all components are inspected. A checklist similar to ASME B30.16, Table 1 for chain hoist, and ASME B30.21, Table 1 for come-a-longs, will be used.
- Maintain records of annual inspections. Maintain a record log or similar, such as external color coding/markings.
- Repairs or alterations to hoists will be made by the manufacturer's representative or manufacturer's trained personnel only. After all repairs or alterations are completed, test the hoist per ASME B30.16-2.2 Testing.
- In situations where AECOM is required to use client-provided rigging, repairs or alterations will be made in accordance with manufacturer's recommendations.

1.4.14 Maintenance

- Conduct preventive maintenance per the manufacturer's recommendations.
- Use replacement parts at least equal to the original manufacturer's specifications.
- Use a competent person to perform adjustments, repairs, and replacement of parts as per ASME B30.16.

- Do not make repairs by welding or reshaping the hoists or components.
- Keep chains and wire rope load lines lubricated, in accordance with the owner's manual. Lubricants shall be of a type appropriate to the rope or chain and that does not hinder thorough inspection.

1.4.15 Operations

- The operation of a hoist is to be performed by a trained individual only. For powered hoists, the operators shall be trained in all operating controls, warnings, limitations, capacity, and operation instructions found in the owner's manual.
- Do not allow the operator to adjust or repair a hoist unless qualified to perform the maintenance on the hoist.
- Allow only one qualified signal person to give signals to the operator. Only an emergency stop signal will be accepted from anyone.
- Operate hand hoists with hand power only, and only by one person.
- Do not operate hoists with an extension (cheater bar) on the lever.
- Do not load the hoist beyond its capacity.
- Do not wrap the hoist chain or wire rope around the load. Attach the load using a sling or suitable attachment point.
- Use proper rigging and rigging techniques to attach the load.
- The operator shall confirm that the load line is not kinked or twisted before applying the load.
- Do not allow the hoist or body frame to bear against any object or the supporting structure.
- Do not lift or move the load over personnel.
- The operator shall not release the hoist lever until the ratchet and pawl are engaged and the lever is at rest.
- The operator shall not engage in any activity that will divert the operator's attention while operating a hoist.
- The load shall be balanced under the hoist.
- The operator shall not leave a suspended load unattended unless specific precautions have been instituted and are in place.

1.5 Below-the-Hook Lifting Devices

- 1.5.1 This Section only pertains to lifting beams (spreader beams), balance pallet lifters, balancing "C" hook, and plate clamps. Refer to ASME B30.20-2006 for all other below-the-hook lifting devices.
- 1.5.2 The rated load and all required information for lifting devices shall be legible, and on the lifting devices.
- 1.5.3 Provide all devices with individual, legible-rated loads and required information, if multiple lifting devices are assembled for use.
- 1.5.4 All below-the-hook lifting devices shall be in accordance with ASME BTH-1 design criteria.
- 1.5.5 Identification
 - Mark all structural and mechanical lifting devices with, but not limited to, the following:
 - The manufacturer's name and address
 - Serial number
 - Weight of device (if over 100 pounds [45 kilograms])

- Rated load.
- Mark repaired or Modified Lifting Devices with, but not limited to, the following:
 - Name and address of the person/company that repaired or modified the device
 - Person/company unit identification marking
 - Lift weight (if altered).

1.5.6 Inspections

- Designate a qualified person to conduct an initial inspection prior to initial use to verify compliance with ASME B30.20.
- Every lift – Confirm that the operator performs a visual inspection prior to and during each lift.
- Document frequent visual inspection.
 - Normal service: Monthly
 - Heavy service: Weekly to monthly
 - Severe service: Daily to weekly
 - Special or infrequent service: As recommended by a qualified person before use, and after each use as directed by a qualified person.
- Periodic visual inspection
 - Inspection conducted by a qualified person making records of external condition for continued evaluation.
 - An external code mark on the device is an acceptable identification in lieu of records.

1.6 Wire Rope Slings

- 1.6.1 All wire rope slings shall meet the requirements specified in ASME B30.9-2010 or most current, as well as any other project-specific regulations.
- 1.6.2 The sling manufacturer is required to provide initial identification tag. Request that identification tags be installed on both ends of the sling when an order is placed with the sling manufacturer.
- 1.6.3 Wire rope sling identification tags shall include:
 - Name or trademark of the manufacturer.
 - Rated load for type(s) of hitch(es), and the angle upon which it is based.
 - Diameter or size.
 - Number of legs, if more than one.
 - Serial number (may request from sling manufacturer, but not required).
- 1.6.4 Wire rope slings shall have a design factor of no less than 5:1. For safety factors refer to *S3NA-310-ATT4 Wire Rope Safety Factors*.
- 1.6.5 Wire rope slings shall be manufactured from new/unused regular lay cable. Do not use rotation resistant wire rope.
- 1.6.6 Wire rope slings may have either a fiber core, strand core, or independent wire rope core.
- 1.6.7 Do not use wire rope slings for overhead hoisting that have hand-tucked eyes, eyes that are created with cable clamps, or eyes that are created with molly hogans.
- 1.6.8 Wire rope slings do not have to be proof-loaded unless required by the project specifications. If proof-loading is required, it shall be done in compliance with ASME B30.9-2.6.2 - Proof Loading Requirements.

- 1.6.9 When required by project site specifications, proof-loading certificates shall be provided with the delivery of all new wire rope slings. The certificate shall include some form of identification of the wire rope sling and the load in pounds that was used in the proof load.
- 1.6.10 Do not use wire rope slings that do not comply with the requirements of ASME B30.9-2010 unless approved for use by a qualified person.
- 1.6.11 Store wire rope slings in a dry environment where they will not be exposed to mechanical damage, corrosive action, extreme temperatures, or extreme heat. Extreme heat would include—but not be limited to—welding and burning operations, electrical currents, or other heat sources.
- 1.6.12 Keep wire rope slings lubricated, in accordance with the sling manufacturer's recommendations. Lubricants shall be of a type appropriate to the rope and that does not hinder thorough inspection.
- 1.6.13 Minimize the exposure to dust that may cause internal wear when storing wire rope slings.
- 1.6.14 Inspections
 - Confirm wire rope slings have legible identification tags containing the required information as described in this section.
 - If one of the two identification tags is not present, a decision shall be made by a competent person to install the replacement tag, or continue to use the sling with the remaining tag in place. (Note: This only applies to sites using dual tag sling marking procedures.)
 - Perform inspections of wire rope slings before each use.
 - The inspection shall be performed by a competent person designated by the employer.
 - Use a cotton cloth to inspect wire rope. Move the cloth slowly up and down the wire rope. If it snags, stop and visually inspect the location for broken wires.
 - Follow up with a complete visual inspection as some broken wires will not snag the cloth.
 - Also check for discoloration (heat damage, corrosion), structural damage, and measure the diameter
 - Written records are not required for frequent inspections.
 - Periodic inspection intervals shall not exceed one year. If a wire rope sling is used in an environment that may cause damage or excessive wear, the periodic inspection interval shall be no more than weekly, or as working conditions prevail, as deemed appropriate by a competent person. Written records are required for periodic inspections. The written records shall include sling identification number. Documentation will be recorded on Attachment 041-2 AMER (Wire Rope and Hook Inspection). Refer to ASME B30.9-2.9.3(b), 2010.
- 1.6.15 Removal Criteria
 - Remove wire rope slings from service if any of the Inspection Requirements are not met.
 - Remove wire rope slings from service if any of the individual strand wires have corrosion pits, or if there are any signs the core, end fittings, or mechanical sling eye fittings have indications of hidden corrosion.
 - Remove wire rope slings from service if the core is exposed.
 - If any broken wires are found on a wire rope sling, reference ASME B30.9-2010; paragraph 9-2.9.4 for removal guidelines.
 - Repair a sling only under certain conditions, as stated in ASME B30.9-2010.
 - Treat individual wires that are broken, crushed, bent, and kinked as broken wires, as far as removal is concerned. Reference ASME B30.9-2010 9-2.9.4 for removal criteria. Use a magnifying glass for the inspection.

- Remove any wire rope slings that have crushed areas in the body. Flattened areas at the ends of the eyes are acceptable, as long as none of the individual wires have the types of damage that are stated in this Section.
- Request the on-site rigging inspector to qualify wire rope slings with areas that may be questionably classified as “bends and kinks.”
- Remove wire rope slings from service if the end fittings or mechanical eye fittings show signs of internal corrosion, or are bent, gouged, crushed, or show any other signs of wear or damage.
- Remove wire rope slings from service if there is any cause to question the sling’s integrity or ability to work at its rated capacity.

1.7 Rigging Hardware

- 1.7.1 Hardware includes shackles, links, rings, swivels, turnbuckles, eyebolts, hoist rings, wire rope clips, wedge sockets, rigging blocks, and load-indicating devices.
- 1.7.2 Stand clear of all rigging when it is under tension.
- 1.7.3 Store rigging in areas safe from damage, corrosive environment, or extreme heat.
- 1.7.4 The terms “rate load” and “working load limit” are commonly used to describe hardware loads.
- 1.7.5 Do not exceed the manufacturer’s recommended safe working loads.
- 1.7.6 Do not use rigging or rigging hardware that has been or appears to have been modified in any manner.
- 1.7.7 All rigging hardware shall have the following markings by the manufacturer cast or stamped onto them, or otherwise attached to them.
 - Name or trademark of the manufacturer
 - Rated load
 - Size.
- 1.7.8 Rigging hardware design factors may differ on some items from a 5:1 factor. Refer to ASME B30.20-2010 for individual hardware safety design factors.
- 1.7.9 Inspection
 - Initial inspection shall be completed by a competent person prior to use. Documentation of the inspection is not required.
 - Frequent Inspection: Performed by the user or a competent person, this is a visual inspection to be completed daily prior to use, and more frequently if required by use. Documentation of the inspection is not required.
 - Periodic inspections shall be completed by a competent person; the time for these inspections shall not exceed 1 year. The inspection shall include the items listed below for removal from service.
 - Rigging hardware shall be taken out of service when damage such as the following is visible:
 - Missing or illegible manufacturer’s name or trademark and/or rated load identification.
 - Indications of heat damage, including weld spat or arc strikes.
 - Excessive pitting or corrosion.
 - Bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
 - Excessive nicks or gouges.

- A 10% reduction in the catalog dimension at any point around the body or pins.
- Incomplete pin engagement.
- Excessive thread damage.
- Evidence of any unauthorized welding.
- Unauthorized replacement components.
- Insufficient number of wire rope clips (if applicable).
- Improperly tightened wire rope clips.
- Indications of damaged wire rope.
- Indications of wire rope slippage.
- Other conditions, including visible damage, that cause doubt as to their continued use.

1.7.10 Shackles

- Do not use round-pin shackles with cotter-pin retention for hoisting unless they have an inline load.
- The screw pin shall fully engaged and tight, and the shoulder is in contact with the shackle body.
- Loads applied to shackles shall be centered in the bow.
- When shackles are used in a choker hitch, the pin shall be in the choking eye of the sling.

1.7.11 Adjustable Hardware (turnbuckles, eyebolts, eye nuts, and swivel hoist rings)

- Turnbuckles, eyebolts, and eye nuts shall have the manufacturer's name/trademark, size, or rated load, and grade for alloy eyebolts clearly labeled.
- Swivel rings shall have the manufacturer's name/trademark, rated load, and torque value clearly labeled.
- Adjustable hardware identification shall be provided by the manufacturer.
- Eyebolts & Eye Nuts
 - Use non-shouldered eyebolts for in-line loads only.
 - Confirm that shouldered eyebolts are flush and securely tightened, and rated loads reduced for angle of load induced.
 - Confirm that eyebolts are aligned with the direction of pull. Steel washers may be used to position the alignment to angle of load induced.
 - Confirm that eye nuts have full tread engagement and are secured against rotation under loading.
 - Use eye nuts for in-line loads only.

1.7.12 Compression Hardware (wire rope clips and wedge sockets)

- Wire Rope Clips
 - Consult the rope clip manufacturers, or qualified person, before installing clips on plastic or impregnated wire rope.
 - Place the saddle on the live end and the U-bolt on the dead end when ending terminations.
 - Use the minimum number and spacing of clips as per the manufacturer or qualified person recommendations.

- Tighten clips to the proper torque as recommended by the manufacturer or qualified person.
- Load the assembly to at least the expected working load both before and after putting it into service. Once the load is removed from the assembly, retighten clips to the proper torque, as recommended by the manufacturer or qualified person.
- Do not use wire rope clips to form eyes in slings for hoisting.
- Wedged Sockets
 - Assemble sockets as recommended by the manufacturer. Live end of the connection shall be in line with sockets pin.
 - Match the socket and wedge assembly for the rope size being installed.
 - Do not interchange wedges between the manufacturers, sockets, or models.
 - Secure the dead end tail extending beyond the wedge, as recommended by the manufacturer.
 - Do not secure dead end of the rope to the live end of the wire rope (unless a double saddle clip of the proper size is used).
 - Apply a load to fully seat the wedge before use after assembly of the wedge socket is complete.
- Links, Rings, and Swivels (including oblong, round, and pear-shaped links and rings, eye-and-eye, and eye-and-jaw types used for positioning)
 - Confirm the link or ring is the correct size and shape for proper seating in a hook, lifting device, or rigging hardware.
 - Confirm that multiple slings or rigging gathered in a link or ring do not exceed a 120-degree included angle.
 - Confirm the horizontal angles are not used less than 30 degrees for links and rings.
 - Forged swivels are positioning hardware, and should not rotate under loading. Confirm that swivels only have "in-line" loads applied to them.
- Rigging Blocks (including tackle, utility, rolling, and snatch blocks)
 - Load fittings on blocks may include hooks, eyes, swivels, yokes, bails, shackles, and pins.
 - These blocks shall have markings displaying manufacturer, rated load, and rope size(s).
 - The minimum allowable D/d between the sheave pitch diameter and wire rope diameter is 6.
 - For hooks attached to blocks, removal criteria are specified in ASME B30.10-1.2.3(a).
 - Applied to a rigging block need to be in line with the sheave(s) and load fittings to prevent side loading.
- Detachable Load-Indicating Devices (including crane scales, dynamometers, and shackles with load-indicating pins)
 - Mark load-indicating devices (LIDs) by the manufacturer to show the manufacturer's name, rated load, serial number, and model number.
 - Prior to use, confirm all new, altered, modified, or repaired LIDs are calibrated to within +/- 2% of the LID's maximum rated load; this should be done by the manufacturer or a qualified person.
 - Maintain a written record of the most recent calibration.

- Perform a periodic calibration at an interval specified by the manufacturer or a qualified person.
- Confirm the load applied to the LID is on its centerline and in tension.
- Multiple slings should not be applied to the pin of a shackle with a load-indicating pin.
- Do not side load the LID.

1.8 Metal Slings

1.8.1 Alloy Steel-Chain Slings

- Sling Identification
 - Mark each sling to show:
 - Grade
 - Nominal chain size
 - Number of legs
 - Rated loads for the vertical hitch and bridle hitch and the angle
 - Length (reach)
 - Individual sling identification.
 - Manufacturer name or trademark
- Inspections
 - Proof coil steel chain, also known as common or hardware chain, shall not be used for rigging or hoisting purposes.
 - Wrought iron chains in constant use shall be annealed or normalized in accordance with the applicable jurisdictional requirements (e.g. California – at intervals not exceeding 6 months) and according to manufacturer's specifications.
 - Initial Inspection – Prior to use, all new, altered, modified, or repaired slings shall be inspected by a competent person to verify compliance with the applicable provisions of this Section.
 - Frequent Inspection – A visual inspection for damage shall be performed by the user or the competent person each day or shift, before use.
 - Periodic Inspection – A complete inspection for damage of the sling shall be periodically performed by a competent person. Examine each link and component individually, taking care to expose and examine all surfaces, including the inner-link surfaces.
 - Maintain a written record of the most recent periodic inspection, including the condition of the sling. Documentation will be recorded on Attachment 041-1 AMER (Sling and Choker Inspection).
 - Periodic inspection intervals shall not exceed 1 year. Base the frequency of periodic inspections on:
 - Frequency of sling use
 - Severity of service conditions
 - Nature of lifts being made
 - Experience gained on the service life of slings used in similar circumstances.
 - Guidelines for the time intervals for the periodic inspections are:
 - Normal service – Yearly

- Severe service – Monthly or quarterly
- Special service – As recommended by the competent person.
- Removal Criteria
 - Remove an alloy steel chain sling from service if conditions such as the following are present:
 - Missing or illegible sling identification.
 - Cracks or breaks.
 - Excessive wear, nicks, or gouges. Reduction in the thickness of the chain links, as listed in Table 6 of ASME B30.9.
 - Stretched chain links or components.
 - Bent, twisted, or deformed chain links or components.
 - Evidence of heat damage.
 - Excessive pitting or corrosion.
 - Lack of ability of chain or components to hinge (articulate) freely.
 - Weld splatter.
 - Other conditions, including visible damage, that cause doubt as to the continued use of the sling.
- Repair
 - Slings shall be repaired only by the sling manufacturer.
 - In situations where AECOM is required to use client-provided rigging, repairs will be made in accordance with manufacturer's recommendations.

1.8.2 Metal Mesh Slings

- Sling Identification
 - Each sling shall be marked to show:
 - Name or trademark of the manufacturer.
 - Rated loads for the type(s) of hitch(es) used and the angle upon which the rating is based.
 - Width and gauge.
 - Serial number
- Inspections
 - Initial Inspection – Prior to use, all new, altered, modified, or repaired slings shall be inspected by a competent person to verify compliance with the applicable provisions of this Section. Documentation of the inspection is not required.
 - Frequent Inspection – A visual inspection for damage shall be performed by the user or the competent person each day or shift, before use. Conditions such as those listed in this Section or any other condition that may result in a hazard will cause the sling to be removed from service. Slings will not be returned to service until approved by a qualified person. Documentation of the inspection is not required.
 - Periodic Inspection – A complete inspection for damage to the sling shall be periodically performed by a designated person. Inspection shall be conducted on the entire length, including splices, end attachments, and fittings. The sling shall be examined for

conditions such as those listed ASME B.30.9-3.9.4, and a determination made as to whether they constitute a hazard.

- Maintain a written record of the most recent periodic inspection, including the condition of the sling. Documentation will be recorded on Attachment 041-1 AMER (Sling and Choker Inspection).
- Periodic inspection intervals shall not exceed 1 year. Base the frequency of periodic inspections on:
 - Frequency of sling use
 - Severity of service conditions
 - Nature of lifts being made
 - Experience gained on the service life of slings used in similar circumstances.
- Guidelines for the time intervals for the periodic inspections are:
 - Normal service – Yearly
 - Severe service – Monthly or quarterly
 - Special service – As recommended by the competent person.
- Removal Criteria
 - Remove a wire mesh sling from service if conditions such as the following are present:
 - Missing or illegible sling identification.
 - Broken weld or a broken brazed joint along the sling edge.
 - Broken wire in any part of the mesh.
 - Reduction in wire diameter of 25% due to abrasion, or 15% due to corrosion.
 - Lack of flexibility due to distortion of the mesh.
 - Distortion of the choker fitting so the depth of the slot is increased by more than 10%.
 - Distortion of either end fitting so the width of the eye opening is decreased by more than 10%.
 - A 15% reduction of the original cross-section area of any point around the hook opening of the end fitting.
 - Visible distortion of either end fitting out of its plane.
 - Cracked end fitting.
 - Slings in which the spirals are locked or without free articulation shall not be used.
 - Fittings that are pitted, corroded, cracked, bent, twisted, gouged, or broken.
 - Other conditions, including visible damage, that cause doubt as to the continued use of the sling.
- Repair
 - Slings shall be repaired only by the sling manufacturer.
 - In situations where AECOM is required to use client-provided rigging, repairs will be made in accordance with manufacturer's recommendations.
 - Metal mesh and fittings used for sling repair shall comply with the provisions of this Section.

- Do not repair cracked, broken, bent, or damaged metal mesh or components; they shall be replaced.
- All repairs shall comply with the proof requirements of this Section.
- Modifications or alterations to the sling or components shall be considered as repairs, and shall conform to all other provisions of this Section.
- Other
 - When components of a sling have lower rated load capacities than the metal mesh the slings are attached to, the sling shall be identified with a rated load capacity consistent with the lowest load capacity of its components.
 - Do not subject metal mesh slings to a reduction in rated load if used in temperatures below -20 degrees Fahrenheit [°F] (-28°Celsius [C]), and above 550°F (288°C).
 - Use all slings covered by this Section that are elastometer-coated only in a temperature range from 0°F (-18°C) to 200°F (93°C). For operation at temperatures outside these ranges or for other coatings, consult the sling manufacturer for specific data.

1.9 Synthetic Rope, Round, & Webbing Slings

1.9.1 Sling Identification

- All slings shall show the following:
 - Name or trademark of the manufacturer.
 - The manufacturer's code or stock number.
 - Rated loads for the type(s) of hitch(es) used and the angle upon which the rate is based.
 - Type of fiber or synthetic material.
- Sling identification shall be done by the sling manufacturer.
- Sling identification shall be maintained by the user so as to be legible during the life of the sling.
- Replacement of the sling identification shall be considered a repair. Additional proof of testing is not required.

1.9.2 Inspections

- Initial Inspection – Prior to use, a competent person shall inspect all new, altered, modified, or repairs slings.
- Frequent Inspection – Each day or shift, before use, a visual inspection for damage shall be performed by the user or the competent person. Conditions such as those listed in the removal criteria below, or any other condition that may result in a hazard, will cause the sling to be removed from service. Do not return slings to service until approved by the manufacturer. Documentation of the inspection is not required.
- Periodic Inspection – A complete inspection for damage to the sling shall be periodically performed by a designated person. Inspection shall be conducted on the entire length, including splices, end attachments, and fittings. Examine the sling for conditions such as those listed in this Section, and make a determination as to whether they constitute a hazard.
- Maintain a written record of the most recent periodic inspection, including the condition of the sling.
- Periodic inspection intervals shall not exceed 1 year. The frequency of periodic inspections should be based on:
 - Frequency of sling use.

- Severity of service conditions.
- Nature of lifts being made.
- Experience gained on the service life of slings used in similar circumstances.
- Guidelines for the time intervals of periodic inspections are:
 - Normal service – Yearly.
 - Severe service – Monthly or quarterly.
 - Special service – As recommended by the qualified person.

1.9.3 Removal Criteria

- Remove synthetic rope slings from service if conditions such as the following are present:
 - Missing or illegible sling identification.
 - Cuts, gouges, or areas of extensive fiber breakage along the length, and abraded areas on the rope.
 - Damage that is estimated to have reduced the effective diameter of the rope by more than 10%.
 - Uniform fiber breakage along the major part of the length of the rope in the sling, such that the entire rope appears covered with fuzz or whiskers.
 - Inside the rope, fiber breakage, fused or melted fiber (observed by prying or twisting to open the strands) involving damage estimated at 10% of the fiber in any strand, or the rope as a whole.
 - Discoloration, brittle fibers, and hard or stiff areas that may indicate chemical damage, ultraviolet damage, or heat damage.
 - Dirt and grit in the interior of the rope structure that is deemed excessive.
 - Foreign matter that has permeated the rope and makes it difficult to handle, and may attract and hold grit.
 - Kinks or distortion in the rope structure, particularly if caused by forcibly pulling on loops (known as hackles).
 - Melted, hard, or charred areas that affect more than 10% of the diameter of the rope, or affect several adjacent strands along the length that affect more than 10% of strand diameters.
 - Poor condition of thimbles or other components manifested by corrosion, cracks, distortion, sharp edges, or localized wear.
 - Acid or caustic burns.
 - Evidence of heat damage.
 - Broken or damaged core yarns.
 - Weld splatter that exposes core yarns.
 - Other visible damage that causes doubt as to the strength of the sling.

1.9.4 Repair

- Slings shall be repaired only by the sling manufacturer.
- In situations where AECOM is required to use client-provided rigging, repairs will be made in accordance with manufacturer's recommendations.

1.9.5 Other

- Refer to ASME B30.9-2010 for vertical, choker, and basket hitches. For angles other than those shown in these tables, use the rated load for the next-lower angle, or qualified personal will calculate the rated load.
- When components of the sling have a lower-rated load than the synthetic rope with which it is being used, the sling will be identified with a rated load consistent with the lowest load rating of any of the components.
- Polyester and nylon rope slings will not be used in contact with objects or at temperatures in excess of 194°F (90°C), or at temperatures below -40°F (-40°C).
- Do not use polypropylene slings in contact with objects or at temperatures in excess of 140°F (60°C), or below -40°F (-40°C).
- Some synthetic yarns do not retain their published breaking strength during long-term exposure above 140°F (60°C). The rope sling manufacturer should be consulted for the effects of long-term heat exposure.
- Certain chemically *active* environments may weaken or destroy synthetic rope slings. In general, acids may affect nylon, and strong alkalis may affect polyester, both are aggravated by elevated temperatures. In general, polypropylene may be affected by volatile petroleum and other solvents, and most hydrocarbons at elevated temperatures.
- The presence of rust in wet nylon ropes has been found to be potentially harmful. Consult the sling manufacturer before using slings in a chemically active environment.
- Ropes made of polypropylene will be made of fibers that have been produced with an appropriate ultraviolet inhibitor. Slings made of nylon rope should be made of fibers that have been produced with an appropriate ultraviolet inhibitor. Nylon, and particularly polypropylene ropes subjected to long-term exposure to sunlight, should be subjected to an appropriate retirement criteria; consult the sling manufacturer or a qualified person.
- Slings should be stored in an area where they will not be subjected to mechanical, chemical, or ultraviolet damage, or extreme temperatures.
- When used at or in contact with extreme temperatures, the guidance provided in this Section shall be followed.
- Do not store nylon ropes in areas where they may become impregnated with rust.
- Thoroughly rinse slings exposed to salt water with fresh water to prevent mechanical damage from salt crystals when the rope dries.

1.10 Training

- 1.10.1 Personnel shall be trained in the selection of rigging, inspection, cautions to personnel, effects of the environment, and rigging practices.
- 1.10.2 It is recommended that training for riggers be divided into two categories:
 - Training for personnel who do rigging as a major part of their job assignment.
 - Training for personnel who do simple rigging jobs as an incidental part of their job assignment.
- 1.10.3 Topics in both categories shall include the same basics but the depth of detail shall match the job assignment. Topics shall include (but limited to) the requirements listed below:
 - Equipment operating characteristics, capabilities, and limitations.
 - Use and inspection of slings, wire rope, chain, and synthetic fiber.
 - Effects of the environment.
 - Effect of sling angles on resultant sling loads.
 - Restrictions on use of come-along.

- Determination of load weights, load-weight calculations, and individual sling loads.
 - Use of load-indicating devices.
 - Safe work practices.
 - Hand signals and communications between the signal person and operator.
 - Use and inspection of all major rigging accessories or assemblies.
 - Critical lift classifications and requirements.
 - Use of spreader bars and other below-the-hook lifting devices.
 - Be familiar with working around Heavy equipment as outlined in *S3NA-309-PR1 Heavy Equipment*.
- 1.10.4 The rigger shall demonstrate that he/she meets the requirements of this section through a verbal or written test and through a practical test.

Americas

Wire Rope Safety Factors

S3NA-310-ATT4

Cable Size	Approx. Breaking Strength	Factor of Safety & Allowable Load							Weight Lbs/Ft
		7	6	5	4.5	4	3.5	3	
1/2"	-21,200	3,300	3,600	4,300	4,700	5,350	6,050	7,150	.46
	+26,700	3,700	4,450	5,530	5,900	6,700	7,600	8,900	
5/8"	-3,320	4,800	5,550	6,700	7,300	8,350	9,400	11,150	.72
	+41,200	5,900	6,900	8,300	9,100	10,400	11,700	13,900	
3/4"	-47,300	6,700	7,750	9,400	10,500	11,750	13,500	15,700	1.04
	+58,900	8,450	9,850	11,800	13,000	14,800	16,800	19,700	
7/8"	-64,300	9,150	10,650	12,800	14,200	16,000	18,300	21,200	1.42
	+79,600	11,300	13,150	15,800	17,600	19,700	22,700	25,650	
1"	-83,300	11,900	13,950	16,700	18,500	20,900	23,800	27,900	1.85
	+103,300	14,700	17,150	20,300	22,900	25,400	29,500	34,200	
1-1/8"	-105,100	15,000	17,500	21,000	23,300	28,100	30,000	35,000	2.34
	+130,000	18,600	21,300	26,000	28,800	32,300	37,100	43,200	
1-1/4"	-129,100	18,400	21,250	25,900	28,600	32,200	36,800	43,000	2.80
	+168,900	24,100	28,100	33,900	37,500	42,200	48,200	56,200	
1-3/8"	-155,200	22,100	25,900	31,000	34,400	38,900	44,300	51,600	3.50
	+192,000	27,200	32,000	38,200	42,600	48,000	54,800	64,000	
1-1/2"	-184,000	26,200	30,700	36,900	40,800	46,100	52,500	61,200	4.16
	+228,000	32,500	3,800	45,500	50,600	57,000	65,100	76,000	

-6 x 19 I.W.R.C improve plow steel hoisting cable (upper line) 1/2" through 1" diameter.

+6 x 19 I.W.R.C. extra improved plow steel hoisting cable (lower line) 1/2" through 1" diameter.

-6 x 37 I.W.R.C improve plow steel hoisting cable (upper line) 1-1/8" through 1-1/2" diameter.

+6 x 37 I.W.R.C. extra improved plow steel hoisting cable (lower line) 1-1/8" through 1-1/2" diameter.

The above chart is primarily intended to determine safe loads for hoist load lines and guy lines. If used for slings, the values must be reduced by the loss for the type of end fitting.

Americas

Checklist for Lift Planning

S3AM-310-ATT5

This checklist is intended to assist reviewers in confirming completeness of the lift plan. These items are included as a guide but should not be interpreted as being all-inclusive in the analysis and preparation of a Critical or Pre-Engineered Lift. Sound engineering and planning is still the responsibility of the engineer or manager associated with the lift.

Never vary from the approved Lift Plan without a full review and approval by the manager or lift supervisor (if there is one).

Subsurface and Foundation Issues

1. What are the maximum loads imposed by the cranes on the soil/facility floor? Is the soil-bearing capacity adequate to safely support crane loads? Has a soil investigation program been performed? What is the assumed load distribution through the timber mats?
2. Has a soil investigation of the area under the path of the tailing crane (borings, etc.) been performed?
3. What pressures will be imposed on any underground structures (sewer lines, etc.)?

Transportation and Interim Storage Issues

4. Has the responsible supervisor / manager and the SH&E manager been notified of movement of the load to the lifting site (notification at the discretion of the responsible planner)? Are any permits required?
5. Has the load transport route to the lift site been checked for overhead obstructions? Are there any bridges, culverts, pipe ways to cross? Are they structurally capable of safely supporting the transport loads?
6. Where will the crane be assembled? What route will the crane take from the assembly site to the lift site?
7. How will the load transport get to the lift site? How will the transport be removed once the load is lifted?

Crane Issues

8. What is the minimum actual clearance between the load and the boom during the lift?
9. Has the radius been double-checked by measuring in the field?
10. Will the crane load change as the lift progresses?
11. How many parts of line are needed? How was this determined?
12. Is there adequate line length spooled on the hoist drums?
13. Will spreaders and other rigging hardware remain safely clear of the boom, the load, and other objects at all times during the lifting operation?
14. If a tailing crane has to "walk," is the path level and properly compacted?
15. What efforts have been made to identify obstructions in the lift path and swing path? How accurate are these efforts?
16. Can the outriggers be deployed as per manufacturer's load chart requirements?
17. Can rigging personnel safely control and manipulate the load throughout the lifting path?
18. Are the crane's operational safety alarms functioning properly? How, when, and were they tested?
19. Have plans been developed to monitor the crane's stability during lift?
20. Has a procedure been developed to monitor plumbness of load lines (in two directions)?
21. Has a drawing showing the elevation of the crane during the lift as well as all clearances been developed (boom to load, and load to other obstructions)?

- 22. Have all repairs or modifications to the crane been made in accordance with manufacturer's written instructions, and are they so certified?
- 23. Has the crane been load tested recently?
- 24. How will the crane's electronic safety alarms and interlocks be checked for operation and accuracy?
- 25. Has a recent wire rope and hook, load block, ball inspection been performed.
- 26. Has a procedure to monitor tail swing of the crane during lifting operations been developed?
- 27. Is the correct crane load chart for current lift conditions in the cab?
- 28. Is there adequate headroom to ensure that the manufacturer's minimum allowable two-block distance is maintained for the configuration of the reeve used?

Load Weight & Center of Gravity Issues

- 29. How was the weight determined when developing the lift plan? Has any margin been added to calculated weights?
- 30. Has an accurate load weight determination been made before the lift to confirm calculated weight? How was this performed?
- 31. Has the weight of any jibs, auxiliary boom heads, etc. been considered in the calculations?
- 32. Has all the rigging hardware been included in the weight calculations?
- 33. Who has determined the center of gravity? How was it determined? Is it marked on the load? Is it shown on the lift plan drawings?
- 34. Is there anything inside the load that could shift during the lift?
- 35. Has snow or ice accumulated on the load since the weight was determined?
- 36. Is the surface area large enough to create unusual control problems in the wind?
- 37. Has all hydro test water been drained from the load (vessel) before lifting?
- 38. If lifting a dressed device, has the insulation absorbed any water?
- 39. If lift is of an existing item (being removed or demolished), have all anchor bolts and fasteners been removed?

Rigging Issues

- 40. Has all rigging hardware been selected to work within the manufacturer's Safe Working Load?
- 41. Have sling angles flatter than 45 degrees been avoided, and have the slings and shackles been chosen to allow for increased loads due to sling angles?
- 42. Have softeners been used to protect the rigging where sharp corners could cause damage?
- 43. Does the rigging provide positive control of the load to prevent slipping or shifting?
- 44. Are shackles and hooks always used in such a manner as to avoid side bending in the hardware?
- 45. Have qualified personnel designed and tested special rigging hardware in accordance with regulations?
- 46. Is there a plan for removing lifting tackle from the load after it is erected?
- 47. How will the shackle pins be removed after the lift is complete? Will a pin extractor be required, and if so, manual or hydraulic?
- 48. What level of inspection have the shackles, hooks, slings, etc. been subjected to?
- 49. Are the shackle pins and lifting eyes compatibly sized?
- 50. How will side loading/bending of shackles and hooks be avoided?

- 51. Have all rigging components such as shackles, hooks, and slings, been inspected for signs of damage or deterioration before use?
- 52. Is the rigging arranged to have the crane hook directly over the load's center of gravity with the load hanging level?

Roles & Responsibility Issues

- 53. Who is the responsible manager / supervisor for the lift? What are their qualifications? Who will give the signals to the operator?
- 54. Has the SH&E manager been involved in the lift planning process or lift plan review?
- 55. Has the appropriate Project Manager/Facility Manager been involved in the lift planning process or lift plan review?
- 56. Has the lift plan been reviewed with the crane operator, riggers, and others involved in the lifting operation? Has the plan been reviewed with supervisors and workers in adjacent areas?
- 57. Has a chain of command to operate during the lift been established, and how are the involved people identified?
- 58. Has a final pre-lift safety meeting been scheduled?
- 59. Are there any language difficulties? Does everyone speak (fluently) the same language?

Operational Envelope Issues

- 60. What are the limits on wind speed for making the lift? How and where will wind speed be measured?
- 61. Is cold weather likely to affect the lift? Is it necessary to de-rate the crane or any part of the rigging equipment due to low temperatures?
- 62. Is adequate lighting equipment available for use, if the lifting operation should extend beyond normal daylight hours?
- 63. Are required personnel (operations, safety, other) available if the lift operation should extend beyond normal hours?
- 64. Are there overhead power lines in the operating area? If so, have minimum clearance requirements been established and has a dedicated signal person been assigned to monitor boom, load and/or load line position relative to the power line?
- 65. If operating near overhead power lines, are nonconductive taglines being used? Emergency Procedural Issues
- 66. Have emergency procedures been determined and communicated to all personnel involved in the lifting operation?
- 67. If required, has confirmation of notification to adjacent Departments/Divisions/Concurrent Operations and local Security and Fire Rescue been received?
- 68. Has agreement been established on required actions if operational alarms occur during the lift?
- 69. Has a review of operational activities planned/occurring during time of lift been performed?
- 70. Has a review/agreement of safety / barricade/evacuation plans been done?
- 71. Has a review/agreement of contingency plans in event of a site alarm or operational upset during lift been made?
- 72. Have emergency plans been developed by, communicated to, and understood by operating personnel? Does the lift plan reflect the philosophy that safety is the top priority?

Load Design Follow-up Issues

73. Is the load fragile enough to require lifting from a “strong back” frame or from multiple attachment points to prevent load damage?
74. Has the “strong back” frame been designed by a competent engineer, inspected, and load-tested?
75. Has any required nondestructive testing been done to assess the quality of welds attaching lifting lugs, pad eyes, trunnions, etc.?
76. Has anyone checked that the shackle pins will fit the holes provided in the lifting lugs?
77. Are the dimensions of the lifting lugs/pad eyes consistent with the size of shackle proposed? Will the shackle be able to “turn” as the load goes from horizontal to vertical?
78. Have the appropriate impact factors been used in designing the lifting lugs, shackles, etc.?
79. Is there enough clearance between the load and the lifting lug/pad eye to get the nut on the shackle pin?
80. What are the inspection requirements for the lifting attachments (lugs/pad eyes)? Who will do it?
81. Has the load (tower) design been analyzed for localized buckling and bending shear stress during the lift operation in order to verify that allowables will not be exceeded during the lift?
82. If trays or internals are to be installed before lifting, has the possibility of load shift been considered?
83. Are all engineered lifting components (spreader bars, lift lugs, etc.) designed to ASME B30.20, Below-the-Hook Lifting Devices? (Show calculations on Lift Plan).
84. Are the lifting lugs designed about the weak axis using a force equal to a minimum of 5% of the force of the sling? (Show calculations on Lift Plan).
85. Who has designed the lifting lugs/trunnions? Has design been checked by a qualified engineer?

Peripheral Issues

86. Are radios required? Who will provide them? Are they safe for use in operating facilities?
87. Has a review/agreement of communications plan during lift (i.e., dedicated radio channels) been made?
88. Has the anchor bolt pattern, if required, been checked to confirm the load can be landed properly?
89. Will critical spare parts be available for the crane(s) during the lift? Are mechanics available?
90. Has a drawing showing the barricade plan to be used during the lift been developed?
91. Is a back-up operator available in case of emergency?
92. Are crane maintenance personnel available during the lift?

Ladders

S3AM-312-PR1

1.0 Purpose and Scope

- 1.1 To establish the minimum requirements for AECOM to use, handle, and store ladders.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Stepladder** – A self-supporting portable ladder that is non-adjustable in length, with flat steps and hinged spreader design to connect the front and rear rails. It may be collapsed for ease of storage. It is intended for use by one person.
- 2.2 **Single Ladder** – A non-self-supporting portable ladder that is non-adjustable in length, consisting of one section. It is intended for use by one person.
- 2.3 **Articulated Ladder** – A portable ladder with one or more pairs of locking hinges which allow the ladder to be set up in several configurations such as a single or extension ladder, with or without a stand-off, a stepladder, a trestle ladder, scaffold or work table.
- 2.4 **Extension Ladder** – A non-self-supporting portable ladder that is adjustable in length. It consists of two or more sections that travel in guides or brackets arranged so as to permit length adjustment. It is intended for use by one person.
- 2.5 **Fixed Ladder** – A non-self-supporting ladder that is non-adjustable in length and permanently attached to a structure at a pitch ranging from 60 degrees to 90 degrees from the horizontal. The preferred pitch of a fixed ladder is between 75 degrees and 90 degrees from the horizontal. A fixed ladder is considered to be of "Substandard Pitch" if it is installed at an angle between 60 degrees and 75 degrees from the horizontal. Fixed ladders having a pitch greater than 90 degrees are not allowed.
- 2.6 **Job-Made Ladder** – A custom, made-to-fit specific job situations during construction or demolition operations. Their primary purpose is to provide access to or egress from a work area. They are not intended to serve as a workstation. They are temporary in nature and serve only until a particular phase of work is completed or until permanent stairways or fixed ladders are ready for use. Job-made ladders must be in full compliance with local regulations.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-216-PR1 Compliance Assurance
- 3.3 S3AM-208-PR1 Personal Protective Equipment
- 3.4 S3AM-209-PR1 Risk Assessment & Management
- 3.5 S3AM-304-PR1 Fall Protection

4.0 Procedure

- 4.1 Roles and Responsibilities
 - 4.1.1 **Managers**
 - Responsible for the implementation of this procedure and compliance with local regulations for supervised employees.

4.1.2 SH&E Managers

- Provide guidance as to application of the procedure.

4.1.3 Employees

- Adhere to this procedure, apply appropriate precautions and work practices in their use of ladders.

4.2 Training

4.2.1 All Employees who will climb above 6 feet (2 meters) shall take Fall Prevention / Protection Training. Refer to the *S3AM-304-PR1 Fall Protection* procedure.

4.2.2 All Employees will be oriented to the hazards and controls of any ladders present on the site and be aware of the safety planning and Task Hazard Assessment (THA) in accordance with *S3AM-209-PR1 Risk Assessment & Management*.

4.2.3 All Employees involved in the use of ladders on the project / location will be instructed in the requirements of this procedure.

4.3 Personal Protective Equipment (PPE)

- Personal fall protection equipment must be worn when working above the regulated height in your location. Refer to the *S3AM-208-PR1 Personal Protective Equipment* and *S3AM-304-PR1 Fall Protection* procedures for more specifics.
- PPE must be appropriate for the work location being constructed or industrial work site and/or client requirements.

4.4 Ladders

4.4.1 The following are minimum requirements for the use and care of ladders by AECOM personnel. Compliance with American National Standards Institute (ANSI) standards ANSI A14.1, ANSI A14.3, or Canadian Standard Association (CSA) standard CAN/CSA-Z11-M81 - Portable Ladders and applicable State, Provincial or Territorial regulations is also required. Additionally consider the following:

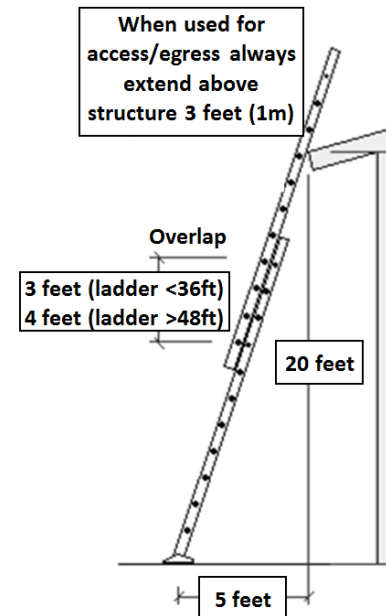
- Ladders shall be visually inspected before use. If a ladder is broken, damaged, or defective, it shall be removed from service and tagged with an "unsafe equipment" tag until made safe for use or destroyed.
 - Ladders will be maintained in good condition at all times. All ladder rungs shall be evenly spaced and securely affixed to the side rails. Ladders shall not have loose, broken or missing rungs, split side rails, or other defects.
 - During the inspection the type, size, length, and load rating (as well as labels and certification stickers) must be verified to ensure the ladder is correct for the work to be done.
 - Refer to the *S3AM-216-PR1 Compliance Assurance* procedure
- Ladders having metal parts (other than hardware) will not be used where potential electrical hazards exist unless they bear a manufacturer's label that indicates:
 - The ladder complies with ANSI 14.5 and CSA Z11-M81.
 - It is approved for electrical use.
 - Site-constructed ladders (vertical construction ladders, straight or job-built ladders) shall be built in accordance with State, Provincial or Territorial regulations.

4.4.2 Use of Ladders

- Use the appropriate type of ladder for the work to be done according to manufacturer's specifications.
 - Ladders are not to be used as a brace, skid, guy or gin pole, gangway or other uses not specified by the manufacturer.

- Single and extension ladders shall be equipped with non-slip safety feet and secured from “kicking out” or slipping (e.g. tied off at the top and bottom, held and stabilized by another worker, or otherwise secured).
- Set up barricades or warnings around ladder if it must be set close to thoroughfares, passageway doors or high traffic locations.
 - A ladder will not be placed in front of a door opening toward the ladder unless the door is blocked open, locked, or guarded.
 - Ladders projecting into passageways or doorways where they can be struck by personnel, moving equipment, or materials must be protected by barricades or guards.
- Areas around the tops and bottoms of ladders shall be kept clear.

- Single rail ladders shall not be used.
- Set the ladder at the proper angle of one horizontal to every four vertical.
- Ladders shall rest on a surface of ample strength to support the load of the ladder and other applied loads. Ladders used for access shall extend 3 feet (1 meter) above the access level.
- Ladders should be set up on a firm level surface.
 - As applicable, use CSA/ANSI approved spike foot ladders for soft surfaces and non-slip foot ladders for hard, smooth surfaces
 - As applicable, if the base is to rest on soft, uncompacted or rough soil, a mud-sill must be used to stabilize the ladder.
- Ladders will not be placed on boxes, barrels, or other unstable bases to form longer sections.
- Do not paint or use painted wooden ladders as paint may hide unsafe wear and tear.



- Only one person shall be on a ladder at any time unless the ladder is designed for use of additional people.
- Always face the ladder when ascending or descending.
- Always maintain three points of contact with the ladder (i.e., two hands and one foot or two feet and one hand).
- Workers must ensure that their bodies are kept between the side rails of the ladder. Extending beyond the side rails or straddling a space between a ladder and another object will reduce the stability of the ladder.
- The Task Hazard Assessment shall consider potential fall hazards, any applicable regulatory requirement by jurisdiction and client requirements when determining whether fall protection must be in place or worn when working from portable ladders.
- Prior to using any ladder, ensure footwear is free of mud, snow, grease or other slippery materials.
- Check for overhead electrical conductors prior to setting up a ladder. Ensure that ladders do not come into contact with or encroach upon the minimum safe distances from energized electrical conductors.
- Do not use metal ladders or wire-reinforced wooden ladders in proximity to energized power lines or electrical equipment. When working near electrical equipment use only wood or fiberglass ladders approved for that use.
- Ladders shall be used for their intended purpose and must not be used horizontally as substitutes for scaffold planks, runways or other service for which they were not designed.

- Never carry materials, tools or other objects when ascending or descending from a ladder. Hoist lines or other appropriate methods should be used to transport materials from one work surface to another.
- Ladders will not be spliced together to form longer sections.
- At no time will a worker stand or sit on the top two rungs of any ladder.

4.5 Fixed Ladders

- 4.5.1 Cage protection is required on fixed ladders of more than 20 feet (6.1 meters) or as specified by local jurisdiction.
- 4.5.2 Landing platforms on fixed ladders shall be provided at heights specified by the given jurisdiction and be equipped with standard railings and toeboards, so arranged as to give safe access to the ladder.
- 4.5.3 As permitted by the applicable jurisdiction, ladder safety climbing devices may be used in lieu of cage protection on fixed ladders or more in height.
 - Landing platforms are not required in these cases except at regular step-off points. All ladder safety devices will be compatible with the ladders with which they are used.
- 4.5.4 Ladder safety climbing devices may be required in addition to cages as specified by jurisdictional legislation.

4.6 Portable Ladders

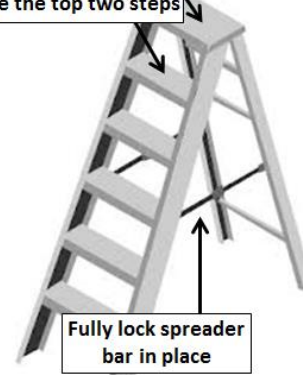
4.6.1 Ladder Types / Grades

- The Occupational Safety and Health Administration, ANSI and CSA all have established “duty ratings” for portable ladders which identifies the conditions under which the ladder can be safely used. The following table generally describes these ratings:

TYPE / GRADE	MAX WORK LOAD	RATED USE
Type IAA	375 lbs (170 kg)	Super Heavy Duty
Type IA	300 lbs (136 kg)	Extra Heavy Duty
Type I	250 lbs (113 kg)	Heavy Duty Industrial
Type II	225 lbs (102 kg)	Medium Duty Commercial
Type III	200 lbs (91 kg)	Light Duty Household
Notes: lbs = pounds kg = kilograms		

- Ladders purchased for use on AECOM sites will be appropriate for industrial applications (Type IAA, IA, I, II). Light-duty household ladders (Type III) are not permitted.
- Ladder type / grade shall be selected according to the proposed task, the ladder’s load capacity, the expected load, and the task’s anticipated hazards to ensure suitability.

Unless jurisdictional regulations and manufacturer specify otherwise, consider these the top two steps



4.6.2 Step Ladders

- The stepladder must be in good condition and the right ladder type/grade for the job to be performed.
- Only use stepladders on clean, even surfaces.
- The platform and top step of ordinary types of stepladders will not be used as steps.
- Do not work from the top two steps of a stepladder. The pail shelf is not a step.
- Only use a stepladder in the fully opened position with the spreader bars locked.

- Do not use stepladders as supports for scaffolds or as a straight ladder.
- Stepladders may be used as a work platform; however, do not over reach while on a stepladder. Climb down and move the ladder to a new position.

4.6.3 Extension Ladders

- Extension ladders are to be used for access to a higher level only, not as a work platform.
- When extended, upper and lower sections of extension ladders must overlap a minimum of:
 - 3ft (1m) if combined sections total less than or equal to 36ft (11m).
 - 4ft (1.25m) if combined sections total 37ft to 48ft (11m-15m).
 - 5ft (1.5m) if combined sections total 49ft to 60ft (15m-18m).
- An extension ladder must be equipped with locks that hold the extension in place.
- Ladders must be tied off.
- Use polypropylene ropes on extension ladders that may be exposed to corrosive chemical.
- Keep both metal and wooden ladders away from electrical sources.
- Where a ladder is used for regular access and egress between levels, platforms should be provided at each landing area.
- The landing areas at both ends of the ladder must be clear of debris and other materials.
- The ladder should be set at the proper angle of one horizontal to every four vertical lengths.

4.6.4 Single ladders shall not exceed the following limits (client or jurisdictional legislation may impose further restrictions):

- Type IAA – 16 feet (5 meters).
- Type IA – 30 feet (9 meters).
- Type I – 30 feet (9 meters).
- Type II – 24 feet (7.5 meters)

4.6.5 Extension ladders shall not exceed the following limits(client or jurisdictional legislation may impose further restrictions):

- Type IAA
 - 3 section length – 36 feet (11 meters)
 - 2 section length – 32 feet (9.5 meters)
- Type IA
 - 3 section length – 72 feet (22 meters)
 - 2 section length – 60 feet (18 meters)
- Type I
 - 3 section length – 72 feet (22 meters)
 - 2 section length – 60 feet (18 meters)
- Type II
 - 3 section length – 60 feet (18 meters)
 - 2 section length – 48 feet (15 meters)

4.6.6 Step ladders shall not exceed the following limits (client or jurisdictional legislation may impose further restrictions):

- Type IAA – 12 feet (3.6 meters).
- Type IA – 20 feet (6 meters).
- Type I – 20 feet (6 meters).
- Type II – 12 feet (3.6 meters)

4.6.7 Care of Ladders

- Ladders will be handled with care and not be subjected to abuse or misuse.
- Immediate inspection and appropriate maintenance is required of any ladder exposed to fire, subjected to damaging chemicals, involved in a fall or collision, or which has become coated with oil or grease. Refer to the *S3AM-216-PR1 Compliance Assurance*.
- When not in use, ladders will be stored where they are protected from potential damage caused by collision, temperature, moisture, etc.
- Users will return ladders to the proper storage location when the job is completed.

5.0 Records

5.1 None

6.0 Attachments

6.1 None

Wildlife, Plants & Insects

S3AM-313-PR1

1.0 Purpose and Scope

- 1.1 Communicates the requirements and precautions to be taken by AECOM employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Field Work** – Any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance, biological surveys, and other work that meets the definition of field work.
- 2.2 **Poisonous** – Capable of harming or killing by or as if by poison; toxic or venomous.
- 2.3 **Phase I Environmental Site Assessment** – Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of Comprehensive Environmental Response, Compensation, and Liability Act defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.
- 2.4 **Phase II Environmental Site Assessment** – Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

3.0 References

- 3.1 RS2-001-PR1 Firearms Standard
- 3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation
- 3.3 S3AM-008-PR1 Fitness for Duty
- 3.4 S3AM-113-PR1 Heat Stress
- 3.5 S3AM-208-PR1 Personal Protective Equipment
- 3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

- 4.1 Roles and Responsibilities
 - 4.1.1 **Managers / Supervisors**
 - Responsible for managing field work.
 - Work with employees to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.

- Implement control measures at the location to reduce the potential for employees to be exposed to injuries and illnesses from biological hazards while working.
- If the exposures cannot be eliminated or managed with engineering controls, approve the use and cost of Personal Protective Equipment (PPE) and protective repellents and lotions and confirm that exposed employees have and use these products.

4.1.2 **SH&E Manager**

- Confirm training and guidance is provided to employees consistent with this procedure.
- During the performance of site visits, assess the precautions being taken against biological hazards for compliance with this procedure.
- Assist AECOM personnel in identifying hazards and selecting appropriate control measures.
- As applicable, review and approve relevant SH&E Plans for locations that have biological hazards.

4.1.3 **Employees**

- Participate in required training related this procedure.
- Participate in the development of THAs for the task, identify control measures to limit exposure and request PPE, repellents, and protective lotions identified by this procedure.
- Update the applicable THA when a new, unaccounted for biological hazard is identified. Employee shall stop work to identify appropriate elimination or control measures (and obtain any necessary guidance) before continuing work.
- Obtain approval from Managers and/or Supervisors to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting (e.g. tick bites, skin irritations, etc.) as detailed within the procedure and attachments.

4.2 **Training**

- 4.2.1 Employees shall be trained to recognize organisms that represent a threat in the regions in which they work – experienced field staff shall provide on the job training to assist staff with hazard recognition.
- 4.2.2 Employees shall be properly trained to the anticipated tasks and the associated required PPE.

4.3 **Overview**

- 4.3.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to AECOM employees. Note that this discussion is not a fully encompassing list of hazards. As part of the SH&E Plan and THA developed by the AECOM personnel, in accordance with *S3AM-209-PR1 Risk Assessment & Management*, additional consideration shall be given to other biological hazards.
- 4.3.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this procedure.
- 4.3.3 If additional biological hazards are identified, employees should stop work and contact the SH&E Manager to discuss the hazards and identify effective control measures. Those control measures shall be implemented at the location prior to restarting work.

4.4 **Employee Sensitivity**

- 4.4.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will

occur, or how severe the reaction will be. Employees should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.

4.4.2 Employees also need to consider whether they are sensitive to the use of insect repellents.

4.5 Planning and Hazard Assessment

4.5.1 AECOM personnel shall confirm that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this procedure are integrated into the THA planning process and conveyed to employees conducting the field work. This information shall be communicated in the location-specific SH&E plan, the THA, pre-project kickoff meetings, and tailgate meetings at the location.

4.5.2 It is important to note that the precautions to be taken by employees to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the task-specific THA in accordance with *S3AM-511-PR1 Heat Stress*.

4.5.3 During the preparation of the location-specific SH&E plan and task specific THA, Managers, Supervisors, and employees shall determine what biological hazards might be encountered during the task or operations and shall prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.

4.5.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40 degrees Fahrenheit (4.5 degrees Celsius) for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.

4.5.5 The hazard assessments shall also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.

4.5.6 Employees in the field where biological hazards exist shall not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the field staff shall stop work and not proceed until the THA has been amended and approved and protective measures implemented.

4.5.7 Employees who have severe allergic reactions are strongly recommended to notify their Manager, field Supervisor and co-workers of the potential for a reaction and demonstrate what medication they might need, where they keep it and how it is administered.

4.5.8 A decision flow chart and table for determining the potential for biological hazards in the Americas has been provided in *S3AM-313-ATT1 Biological Hazard Assessment Flow Chart*.

4.5.9 Restrictions:

- No firearms or weapons are allowed to be used without express permission by the Region Executive and Chief Resilience Officer, refer to the *RS2-001-PR1 Firearms Standard*.
- No weapons related work shall occur without an assessment that includes appropriate hazard control measures and training.
- Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements. Refer to *S3AM-008-PR1 Fitness for Duty*.

4.5.10 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Avoid wearing perfume and cologne and strong smelling deodorants, lotions, soaps, and shampoos.
- When working in areas where there may be small insects that “hitchhike” (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins. Avoid reaching into areas where visibility is limited.

4.6 Wildlife Hazards (Wild Animals, Reptiles and Birds)

4.6.1 Employees shall not work alone in areas where the risk of an encounter with dangerous wildlife is high. Wildlife handling shall only be completed under direct supervision of an experienced individual. Refer to the following work instructions for more specifics:

- S3AM-313-ATT13 *Alligators*
- S3AM-313-ATT9 *Large Carnivores & Ungulates*
- S3AM-313-ATT10 *Bear Safety*
- S3AM-313-ATT11 *Small Mammals*
- S3AM-313-ATT12 *Snakes & Scorpions*

4.7 Ticks, Spiders and other Insects

4.7.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, fire ants and European fire ants.

4.7.2 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. Epi-pens¹ shall be carried at all times in the field by employees who are aware that anaphylactic shock is a possibility for them. AECOM highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

4.7.3 Habitat Avoidance, Elimination and/or Control

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the location of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks and spiders during the clearing process.
- Projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the Manager shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
 - It should be noted that vegetation clearance may unintentionally serve to spread noxious and poisonous plant materials around the site.
 - As applicable, measures should be taken to prevent spread, such as but not limited to, confirming equipment and materials are not placed on affected areas, and equipment is decontaminated after use and before removal from site.

¹ *Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self-administer the dose.*

- When work shall be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile (less than half a kilometer) from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. Managers and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.7.4 Ticks

- Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will attach themselves. The most serious concern is a possibility of contracting a disease.
- Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and, therefore, most related illnesses. The use of permethrin is strongly advised.
- The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in *S3AM-313-ATT2 Ticks* along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.
- Employees should conduct a thorough full body tick check upon exiting the field. Shower within two hours of coming indoors to help wash away loose ticks. Clothes should be laundered in hot water or tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks.
- To remove ticks that are embedded in skin, utilize a tick key. Alternatively use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out. Follow AECOM incident reporting guidelines to report the tick bite within 4 hours and notify the Manager or Supervisor.
- Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If you notice this type of pattern or rash resulting from a tick bite, immediately report the issue to your supervisor and follow the incident reporting requirements for your business group.
- If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.

4.7.5 Chiggers

- Chiggers are mite larvae, approximately ½ millimeter in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.

- Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.

4.7.6 Spiders

- Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.
- Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the U.S. and others outside the U.S. inject a toxin that causes extensive tissue damage and intense pain.
- Additional information on spider identification can be found in attachment *S3AM-313-ATT3 Poisonous Spider Identification*.

4.7.7 Mosquitoes

- When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.
- CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:
 - Eastern Equine encephalitis
 - Western Equine encephalitis
 - West Nile Virus
 - St. Louis encephalitis
 - La Crosse encephalitis
- Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus.
- Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death, so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus. Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See *S3AM-313-ATT4 Mosquito Borne Diseases* for information on the locations where mosquito borne diseases are known to be present.

4.7.8 Bees, Wasps and Hornets

- Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.
- Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, behind covers or lids and even on open ground. Other protective measures are not normally effective against aggressive, flying insects. Be aware of the potential areas for these types of insects, approach these locations cautiously. Avoid reaching into areas where visibility is limited.
- If you see a nest in the area you are working in stop work. Contact the Manager or Site Supervisor for procedures to have the nest removed.
- If stung by a wasp, bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Follow AECOM incident reporting guidelines to report the sting within 4 hours and notify the Manager or

Supervisor immediately. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.

4.7.9 Fire Ants

- The fire ant (southern and western U.S.) and the European fire ant (northeastern U.S. and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.

4.7.10 Personal Protective Equipment (PPE)

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Gloves shall also be worn consistent with the recommendations of the site-specific SWP and/or THA to minimize hand exposure.
- Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically treated clothing will be taped to the work boots.
- See *S3AM-313-ATT2 Ticks* for configuration of clothing for protection against ticks and insects.
- Application of insect repellent to clothing and/or exposed skin. Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work. If permethrin is unavailable employees can apply DEET to their skin and let dry prior to putting FRC on.
 - Oil of Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.
 - Permethrin is an insecticide with repellent properties registered with the Environmental Protection Agency and recommended by the CDC.
 - Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) manual treatment of their personal clothing using Permethrin spray in accordance with manufacturers recommendations. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. AECOM strongly recommends the first option (employees obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *S3AM-208-PR1 Personal Protective Equipment* and with the approval of your Supervisor or Manager.
 - The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for five wash cycles.

- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that shall be applied directly to the skin. Supervisor or Manager approval is required prior to purchase.
- If the employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they shall either: 1) wear Tyvek® coveralls taped to the boots, or 2) wear full-length clothing consisting of long-legged pants and long-sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an oil of lemon eucalyptus to their work clothing.
- Safety Data Sheets (SDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a SDS should be obtained for the products used and placed into the office SDS library and site-specific safety plan.

4.8 Poisonous Plants

4.8.1 Habitat Avoidance, Elimination and/or Control

- If poisonous plants are identified in the work area, employees will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other employees to avoid the designated area. If employees decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the Manager (and Client as appropriate) for approval.
- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion shall need to occur with the Manager (and Client as appropriate) to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- Employees shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure, including PPE, is prepared in advance and approved by the SH&E Manager. The clearing procedure should be included in the SH&E Plan and THA and the required PPE specified.

4.8.2 Poisonous plants that employees should recognize and take precautions to avoid include: poison sumac, poison ivy (terrestrial and climbing), poison oak, giant hogweed² (or giant cow parsnip), wild parsnip, devil's club and stinging nettle. Many others are extremely poisonous to eat (e.g., poison hemlock; water parsnip) – do not eat anything that has not been identified. Refer to S3AM-313-ATT5 *Plants of Concern* for information on locations where some of these poisonous plants are found in the U.S.

- Of the toxic plants in the cashew family, poison ivy (*Rhus radicans*) is most widespread. It grows in a variety of forms such as a low sprawling shrub, dense ground cover, or a thick woody vine that grows high into the tree canopy. Poison oak (*Rhus diversiloba*) is typically a low shrub in drier soils. Both of these plants have leaves of three and white berries. Poison sumac (*Rhus vernix*) is a tall shrub that is less prolific in distribution. It grows in wet areas, has a compound leaf with a red leaf stem (rachis), and white berries. All of these plants possess urushiol oils in all parts of the plant. Touching the plant causes an itchy skin rash that can show up within 4-72 hours following contact. People have a wide range of reactions including swelling, itching, rash and bumps, patches or blisters.
- Urushiol oil can also transfer onto clothing and equipment. The oil can remain active on surfaces for up to 5 years and can be transferred to your skin.
- Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken

² Phytodermatits producer: keep skin covered and wash well after exposure

leaves. See S3AM-313-ATT6 *Wild Parsnip Identification* for additional information and photos of wild parsnip.

- Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the giant hogweed (*Heracleum mantegazzianum*), a plant that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 16 feet (5 meters) in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by meadow parsnip (*Pastinaca sativa*) and cow parsnip (*Heracleum lanatum*). Meadow parsnip can be very abundant on disturbed sites.
- Nettles, particularly stinging nettle (*Urtica dioica*) and wood nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.
- Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. These include the cactus (*Opuntia spp.*), devils club (*Oplopanax horridum*), and prickly-ash (*Zanthoxylon americanum*).

4.8.3 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying to not eat any berries or plants if you are unsure of their identity.

- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.

4.8.4 Personal Protective Equipment (PPE)

- Employees conducting clearing, grubbing, or similarly disturbing work activities in areas where poisonous plants exist shall wear long-sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. Employees shall not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants shall be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- If foliage is being cleared and includes poisonous plants, exposed skin shall be treated with a dermal barrier cream such as Tecnu®'s Oak 'n Ivy Armor or Enviroderm's Ivy Block and either a full-face respirator or a half-face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.

4.9 Bird Droppings and Biological Soil Hazards

4.9.1 Work in any area where pigeons or other flying animals (e.g. bats) may nest requires a written statement from the client which states the potential for, and extent of, accumulation of excrement on/in the structure from pigeons or other winged animals.

4.9.2 Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE. See S3AM-313-ATT8 *Bird Droppings*.

4.9.3 Tularemia is a problem with contaminated soil in some locations. Tularemia is a disease of animals and humans caused by the bacterium *Francisella tularensis*. Rabbits, hares, and rodents are

especially susceptible and often die in large numbers during outbreaks. Workers can contract Tularemia through tick and deer fly bites, but also through inhalation of contaminated aerosols or agricultural dusts. Check work areas for carcasses before disturbing the ground (e.g. mowing, brushing, grubbing, excavation, etc.).

4.10 Personal Hygiene and Body Checks

4.10.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.

4.10.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.

4.10.3 Employees shall shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *S3AM-313-ATT2 Ticks*.

4.11 Employees shall immediately notify their Manager or Supervisor of the presence of an imbedded tick, bee, wasp or hornet sting, other insect bite, rash, or any abnormal reaction. Reporting shall occur within 4 hours for a significant incident and 24 hours for all other SH&E incidents, and in accordance with *S3AM-004-PR Incident Reporting, Notifications & Investigation*.

4.12 The Manager or Supervisor shall forward the report to the SH&E Manager for follow up.

5.0 Records

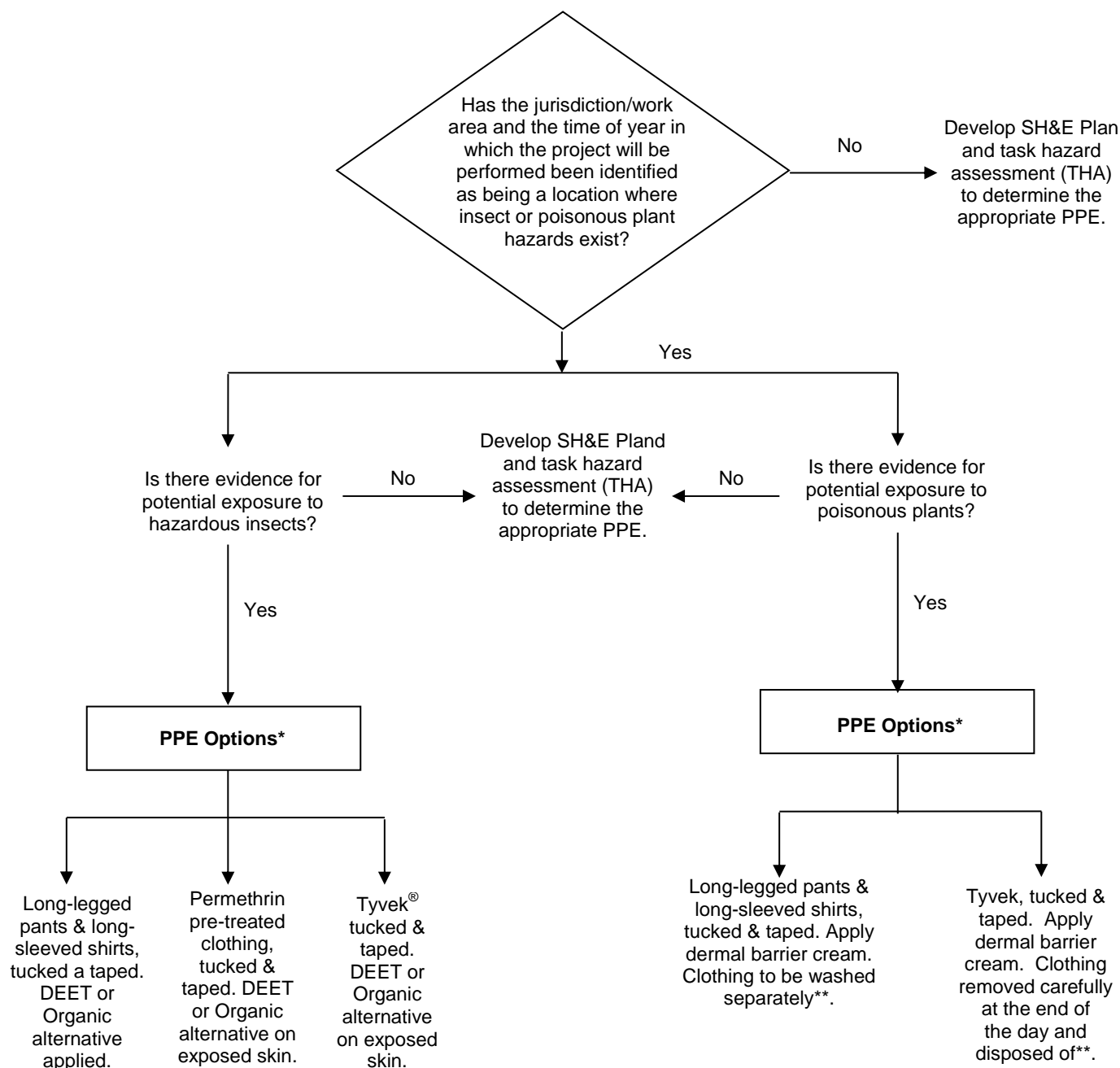
None

6.0 Attachments

- 6.1 [S3AM-313-ATT1 Biological Hazard Assessment Flow Chart](#)
- 6.2 [S3AM-313-ATT2 Ticks](#)
- 6.3 [S3AM-313-ATT3 Poisonous Spider Identification](#)
- 6.4 [S3AM-313-ATT4 Mosquito Borne Diseases](#)
- 6.5 [S3AM-313-ATT5 Plants of Concern](#)
- 6.6 [S3AM-313-ATT6 Wild Parsnip Identification](#)
- 6.7 [S3AM-313-ATT7 Alligators](#)
- 6.8 [S3AM-313-ATT8 Bird Droppings](#)
- 6.9 [S3AM-313-ATT9 Large Carnivores & Ungulates](#)
- 6.10 [S3AM-313-ATT10 Bear Safety](#)
- 6.11 [S3AM-313-ATT11 Small Mammals](#)
- 6.12 [S3AM-313-ATT12 Snakes & Scorpions](#)

Biological Hazard Assessment Decision Flowchart

S3NA-313-ATT1



* indicates that when both insect and poisonous plant hazards are recognized hazards at a project site, the most conservative combination of the available PPE choices will be selected. Include the selected PPE option in the respective SH&E Plan and THA.

** indicates that clothing that has been known or suspected to have come in contact with poisonous plants must be washed before it can be worn again. Similarly, Tyvek® that has been known or suspected to have come in contact with poisonous plants will be disposed of rather than reused during a subsequent day or project.

Americas

Ticks

S3NA-313-ATT2

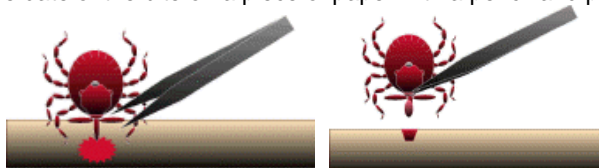
1.0 Background

- 1.1 The Public Health Agency of Canada and the Centers for Disease Control and Prevention work with States and Provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry bacterium that cause disease, including but not limited to:
 - 1.1.1 *Borrelia burgdorferi*, the bacterium that causes Lyme disease.
 - In the United States and Canada, the black-legged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western black-legged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.
 - 1.1.2 *Rickettsia rickettsia*, the bacterium that causes Rocky Mountain Spotted Fever.
 - In the United States and Canada, the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and brown dog tick (*Rhipicephalus sanguineus*) are known to transmit this disease-causing agent.
 - 1.1.3 *Francisella tularensis*, the bacterium that causes Tularemia.
 - In the United States, these include the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and Lone star tick (*Amblyomma americanum*).
 - 1.1.4 *Ehrlichiosis*, the general name to describe several bacterial diseases that affect animals and humans.
 - In the United States, these include the black-legged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western black-legged tick (*Ixodes pacificus*), and Lone star tick (*Amblyomma americanum*).
- 1.2 Consult local health authorities to determine where tick populations are established or emerging. Locations where distribution may have previously been limited may show evidence of larger populations. Employees working in or adjacent to areas where there are established tick populations may have a greater chance of contact with ticks.
- 1.3 While there is a higher risk of coming in contact with infected ticks in areas where populations are established, there is also a low risk of tick-borne diseases being contracted almost anywhere in the Americas as migratory birds transport infected ticks over large geographic distances. Take precautions to reduce tick contact.
- 1.4 Lyme Disease
 - 1.4.1 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae).
 - 1.4.2 Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours).
 - 1.4.3 Infection rates are often greater in tick populations that have been established for long periods of time compared to newly established ones.
 - 1.4.4 Lyme disease patients are most likely to have illness onset in April through November with onset peaking in June, July, or August and less likely to have illness onset from December through March

2.0 To Remove Attached Ticks



- 2.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.
- 2.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)
- 2.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
- 2.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.
- 2.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



3.0 Folklore Remedies Don't Work

- 3.1 Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.

4.0 Configuration of Clothing

- 4.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with "sticky" side out (see figure below).



Americas

Poisonous Spider Identification

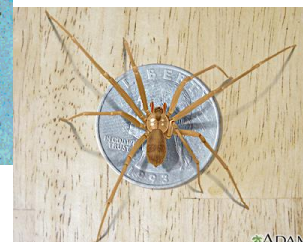
S3NA-313-ATT3

Black Widow Spider

- Found in warm, dry parts of throughout the United States and extend into the southern edge of Canada.
- Prefer to spin their webs in dark, sheltered spots close to the ground
- Abdomen usually shows hourglass marking.
- The female is 1 to 1.5 inches (3-4 centimeters) in diameter.
- Have been found in well casings and flush-mount covers.
- Not aggressive, but more likely to bite if guarding eggs.
- Light, local swelling and reddening of the bite are early signs of a bite, followed by intense muscular pain, rigidity of the abdomen and legs, difficulty breathing, and nausea.
- If bitten, see physician as soon as possible.

**Brown Spiders (Recluse)**

- Central and South U.S., although in some other areas, as well.
- 0.25-to 0.5-inch (0.6 to 1.3 centimeters)-long body and the size of silver dollar.
- Hides in decaying wood, baseboards, ceilings, cracks, and undisturbed piles of material.
- Bite either may go unnoticed or may be followed by a severe localized reaction, including scabbing, necrosis of affected tissue, and very slow healing.
- If bitten, see physician as soon as possible.

**Hobo Spider**

- Primarily found in Washington, Oregon, Wyoming, Colorado, Utah, Montana and the Pacific Northwest United States.
- 0.4-to 0.5-inch (1.1 to 1.3 centimeters)-long body and the size of silver dollar.
- Because of its common features and color, it is easily confused with other spider such as Brown Recluse Spiders.
- They rarely climb vertical surfaces and are uncommon above basements or ground level.
- Bite is initially painless. After 24 hours, the bite develops into a blister and after 24-36 hours, the blister breaks open, leaving an open, oozing ulceration.
- If bitten, see physician as soon as possible.



Exercise care when collecting samples and avoid reaching into areas where visibility is limited. If bitten by a spider, attempt to identify the spider, notify a co-worker or someone who can help should the bite site become painful, discolored, or swollen. Stay calm and treat the area with ice or cold water. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or any swelling or numbness beyond the site of the bite.

Americas

Mosquito-Borne Diseases

S3NA-313-ATT4

1.0 Background

- 1.1 Employees working outdoors in the Americas may be exposed to mosquitoes that may transmit illnesses, including Encephalitis and Dengue.
- 1.2 Dengue is transmitted by the bite of a mosquito infected with one of the four dengue virus serotypes. Dengue is endemic to South America.
 - 1.2.1 Dengue is a febrile illness that affects infants, young children and adults with symptoms appearing 3-14 days after the infective bite.
 - 1.2.2 Symptoms range from mild fever, to incapacitating high fever, with severe headache, pain behind the eyes, muscle and joint pain, and rash.
 - 1.2.3 Severe dengue (also known as dengue hemorrhagic fever) is characterized by fever, abdominal pain, persistent vomiting, bleeding and breathing difficulty and is potentially fatal.
- 1.3 West Nile encephalitis is an infection of the brain that is caused by a virus known as the West Nile virus.
 - 1.3.1 Most individuals infected with WNV remain asymptomatic. West Nile (WN) fever is typically a mild illness lasting 3 to 6 days.
 - 1.3.2 The main symptoms are sudden onset of fever with chills, rash, malaise, headache, backache, arthralgia, myalgia and eye pain. Other non-specific symptoms may include nausea, vomiting, anorexia, diarrhoea, rhinorrhoea, sore throat, and cough.
 - 1.3.3 The main route of infection is via the bite of a mosquito that has been infected by feeding on West Nile Virus infected birds.
- 1.4 Arboviral encephalitis is a virus that exists in various forms in global distribution. Numerous forms occur in the Americas, including the following four primary forms that can be transmitted by mosquitoes:
 - 1.4.1 Eastern equine encephalitis (EEE) – United States and Canada
 - 1.4.2 Western equine encephalitis (WEE) – United States
 - 1.4.3 St. Louis encephalitis (SLE) – United States and Canada
 - 1.4.4 La Crosse (LAC) encephalitis.all of which are transmitted by mosquitoes – United States
- 1.5 Mosquitoes are known to breed in standing water; therefore, when standing water is found at a job site, actions should be taken to drain the water. Typically, mosquitoes will fly only a quarter of a mile (400 meters) from their breeding location.
- 1.6 The local Public Health Department and Center for Disease Control and Prevention (CDC) should be consulted to determine what diseases transmitted by mosquitoes are present and exposure prevention recommendations.

Plants of Concern

S3NA-313-ATT5

1.0 Background

- 1.1 Poison ivy, oak and sumac (poisonous plants) pose a significant threat to AECOM employees due to the dermatitis that results from exposure to the oil on these plants, called urushiol.



Poison Oak

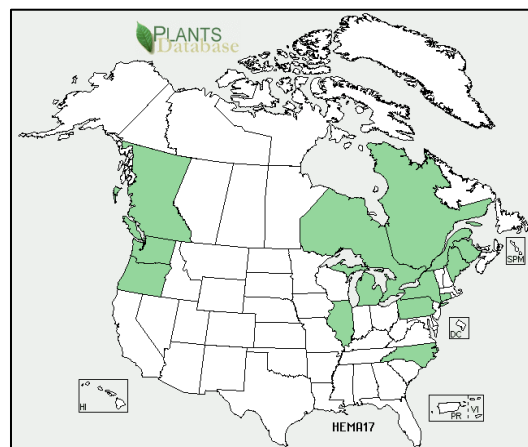
Poison Sumac

Poison Ivy

- 1.2 Exposure to urushiol produces a rash that can be irritating and cause the exposed employee to scratch the infected area, increasing susceptibility for an infection to result from the rash.
- 1.3 It should be noted that each time an employee is exposed to urushiol, it increases the severity of the reaction they will have in subsequent exposures.
- 1.4 Giant Hogweed is a phototoxic plant that causes skin irritation on contact with the sap and, when exposed to sun causes deep blisters.
- 1.5 Blisters from contact with Giant Hogweed can form black or purplish scars that can last for several years. Even a tiny amount of the sap in the eyes can cause temporary to permanent blindness.



Giant Hogweed



Giant Hogweed Distribution

Image obtained from
www.gclandscape.com

2.0 Treatment

- 2.1 In cases that involve severe rashes, medical treatment may be necessary to control the rash.
- 2.2 Employees that develop a rash as a result of exposure to poison ivy, oak or sumac should report the exposure immediately to their Supervisor, Project Manager and Region Safety, Health and Environment Manager.

Pacific Poison Oak Distribution



Image obtained from www.cdc.gov

Atlantic Poison Oak Distribution



Image obtained from www.cdc.gov

Poison Sumac Distribution



Image obtained from www.cdc.gov

Western Poison Ivy Distribution



Image obtained from www.cdc.gov

Eastern Poison Ivy Distribution

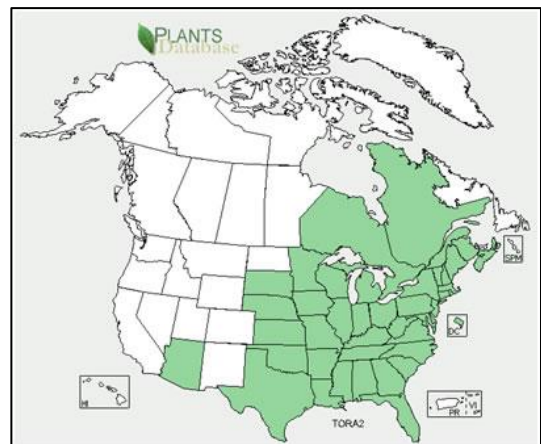


Image obtained from www.cdc.gov

Americas

Wild Parsnip Identification

S3NA-313-ATT6

1.0 Background

- 1.1 Wild parsnip (also known as poison parsnip) looks similar to a large carrot plant and is found in open places along roadsides and in waste places throughout the United States and Canada.
- 1.2 This plant produces a compound that causes severe blistering and discoloration after being exposed to sunlight—a condition known as photodermatitis. That is, when the skin comes in contact with this plant's juice and then is exposed to UV light, a severe burn develops.

2.0 Hazard

- 2.1 Everyone can get burned by wild parsnip. Unlike poison ivy, you don't need to be sensitized by a prior exposure. However, wild parsnip is only dangerous when the juice from broken leaves or stems gets on your skin—therefore, you can touch and brush against the undamaged plant without any danger.
- 2.2 If one gets some of the sap of hogweed (or meadow parsnip or cow parsnip) in contact with skin, it is critical that they stay out of the sun for 8 hours. If one needs to remove the plant they should be completely covered with overalls, gloves, hat and safety glasses.



Americas

Alligators

S3NA-313-ATT7

1.0 Hazard

- 1.1 Your chance of encountering an alligator is greatest during the animal's courtship and mating season, which takes place from March through September. This is when male alligators become most dominant and aggressive as they try to intimidate rival males and attract females by their show of power. Some males end up having to travel to find a mate. July through September is when mother alligators are guarding nests.
- 1.2 Mating season takes up much of the warmer months - a very popular time in the southeastern USA for outdoor activities - and alligators are solar-powered, so-to-speak. The warmth from the sun fires up their metabolism, giving them renewed energy; and renewed energy means great potential for conflict.

2.0 Encounter

- 2.1 The alligator is naturally wary of humans, and will flee quickly if you get too close to it, or it may utter a very audible and compelling warning hiss. In some cases, however, alligators may charge or attack. Here are some examples of such cases:
 - 2.1.1 An alligator that is accustomed to being fed by humans may not be so shy.
 - 2.1.2 An alligator that is surprised and alarmed by your approach may attack, thinking that it is being attacked itself.
 - 2.1.3 A mother alligator caring for her nest or for live babies. If you see alligator babies, or if you encounter a nest (usually a mound of vegetation mixed with mud), remove yourself to a safe distance, the mother alligator is sure to be close by. If you get close, the mother may sound a very audible and intimidating warning hiss. Such a nest may be difficult to identify for a non-expert, but it is likely the mother will issue you a warning.
 - 2.1.4 Alligator mothers are well-known to be practically fearless when defending their offspring, whether the little ones have hatched or not. A mother alligator was observed leaping, jaws agape, to attack a helicopter as it approached the nest area to land. The helicopter carried biologists studying alligator nests.
- 2.2 Also be careful near heavy vegetation in or near the water's edge. This is where an alligator likes to enjoy privacy and peace during the daylight hours. If you trudge through there and surprise it, the outcome may not be positive.
- 2.3 Generally, a good minimum distance to keep between you and an alligator or nest is 15 feet (4.6 meters).
- 2.4 When trying to get past an alligator, make sure not to walk between the alligator and the water, because if it's spooked, it's going to run to the water.
- 2.5 If an alligator does approach in a threatening manner, make as much noise and movement as possible. This should show the alligator that he has taken on more than he can handle and he'll back away.

**3.0 Alligator Charge**

- 3.1 The alligator is not a natural runner. Those short legs obviously don't serve it like a horse's legs do, and the alligator can actually tire out in a relatively short time. When it charges after a human or animal, it is either

trying to scare it away or seize it. It has a fast and furious burst of energy which serves it well for stealth hunting -- grabbing prey when it doesn't expect it. Furthermore, the reptile is opportunistic, which means, quite simply, it doesn't like to work very hard to get its food if it doesn't have to.

- 3.2 In the very rare event you are charged or chased by an alligator, move in as straight a line as possible away from it as fast as you reasonably can. In many cases, the vegetation features of the wild will serve to protect you by slowing the alligator down, like trees, bumps, bushes, etc. -- your comparatively long legs usually make it easier for you to maneuver through the trees and brush than an alligator's short legs do.
- 3.3 Most adult humans can outrun even a fast crocodilian, which has been clocked at a maximum of about 10 miles per hour (mph) (17 kilometers per hour [kph]), compared to a human speed of 15-17 mph (24-27 kph). But this doesn't matter much; an alligator will often give up the chase because it sees that the runner is moving away too quickly, and realizes that too much effort will be required to continue pursuit.
- 3.4 You may have heard somewhere that the zigzag run (running in a "z" pattern, side-to-side) is a good idea, but this is not only an unnecessary maneuver but probably a very unwise one. Here's why:
 - 3.4.1 Unless you're an Olympic athlete, running zigzag over natural topography increases your risk of tripping and falling over rocks, plants, roots, and the like. And it goes without saying that falling while being pursued by an alligator is not good.
 - 3.4.2 Furthermore, an alligator doesn't have the degree of stereoscopic vision we have. It actually has a small 'blind spot' directly in front of it. Hence, the alligator's vision is most effective in the 'sides' of its field of view. So, running zigzag not only slows your rate of distance from your pursuer, it may clearly indicate to the animal exactly where you are; even this point hardly matters since in many cases the alligator may keep its eyes shut while pursuing so as not to get them hit by twigs, grass stalks and branches in its path.
 - 3.4.3 Finally, an alligator bites very effectively in a side-swiping motion, so if you are trying to run zigzag and are slowed down by plants, rocks, or other obstacles, the backwards flying leg of a running human is an optimal target for side-swiping, chomping jaws (the operative word here is "side").
- 3.5 Simply put, when faced with an attack, move directly away from the alligator as quickly as possible, navigating the terrain as carefully as possible. The zigzag idea will likely not serve you well.

4.0 Alligator Attack

- 4.1 If it seizes prey, and the prey fights back hard, the alligator may release it, depending on factors such as its own size relative to that of the victim, its own level of aggression, and its measure of hunger. Merely struggling to break free may not be enough counter-aggression to stop an alligator, and may actually prompt a devastating "death roll" response, in which the reptile furiously spins on its central axis to tear muscle and bone free of the victim's body.
- 4.2 These armored saurian are among the toughest beasts in the animal kingdom, so an attack victim should channel his or her nervous energy and will to survive and take the offensive by fighting hard. Not struggling...fighting very, very, very hard. Others on hand during such an event may be able to help by fighting the reptile, too. This should include punching the snout, poking the eyes, and even jabbing the ears, which are seen as small slits behind the eyes.

Bird Droppings Safe Work Practices

S3NA-313-ATT8

1.0 Background

- 1.1 According to the National Institute for Occupational Safety and Health (NIOSH), histoplasmosis is an infectious disease caused by inhaling spores of a fungus called *Histoplasma capsulatum* (abbreviated *H. capsulatum*) that may inhabit accumulated masses of pigeon droppings and excrement of other birds and flying animals. Its symptoms vary greatly, but the disease primarily affects the lungs. Occasionally, other organs are affected. This form of the disease is called disseminated histoplasmosis, and it can be fatal if untreated. The acute respiratory disease form of histoplasmosis is characterized by respiratory symptoms, a general ill feeling, fever, chest pains, and a dry or non-productive cough. Distinct patterns may be seen on a chest x-ray. Chronic lung disease resembles tuberculosis and can worsen over months or years. If symptoms occur, they may start within 3 to 17 days of exposure, with an average of 10 days. On a positive note, histoplasmosis is not contagious.
- 1.2 Psittacosis, although primarily a respiratory disease, can cause a wide variety of clinical manifestations. Generally, about 10 days after infection occurs, the clinical illness begins abruptly with fever, chills, weakness, fatigue, muscle pain, anorexia, nausea, vomiting, excessive sweating and difficulty with breathing, headache, backache, and sensitivity to light.
- 1.3 Hypersensitivity pneumonitis is also known as pigeon breeder's disease.

2.0 Symptoms

- 2.1 The acute form of hypersensitivity pneumonitis is clinically characterized by chills, fever, cough, breathlessness without wheezing, and malaise 4-10 hours after exposure. In general, an acute attack subsides after 18 to 24 hours.

3.0 Treatment

- 3.1 If a person should develop any of the symptoms as noted above, or others, it is important to see a physician and inform him of an exposure to pigeon/bird or bat excrement. A failure to diagnose the preceding conditions could occur if a treating physician is unaware of a patient's exposure to pigeon/bird or bat excrement.

4.0 Prevention

- 4.1 Prior to work in any area where pigeons or other flying animals may nest, a written statement from the client shall be obtained in regards to the potential for, and extent of, accumulation of excrement on/in the structure from pigeons and other winged animals.
- 4.2 The client shall be asked to provide appropriate details as to the basis for their statement (e.g., date of last visual survey for pigeon/bird or bat excrement accumulation, date of last excrement removal effort, etc.).
- 4.3 In no case will an AECOM employee or contract employee be permitted to commence structure inspection procedures without the Project Manager having received and evaluated the aforementioned written statement from the client.
- 4.4 According to NIOSH, the best way to prevent exposure to *H. capsulatum* spores during survey and inspection work is to avoid situations where excrement and other potentially contaminated material can become airborne and inhaled. Therefore, it is preferable that the efforts to determine if, and to what extent, there is an accumulation of pigeon/bird or bat excrement on/in structures, or the efforts to clean-up/remove/dispose of such contaminated material, be left to the client or subcontracted out.

5.0 Safe Work Practices

- 5.1 In those cases where AECOM employees or contract employees are contracted by the client to determine the extent of accumulation of animal excrement in/on structures, the following minimum safety and health precautions shall be taken. (NOTE: precautionary measures are based on recommendations and best practices prescribed in the NIOSH 2004 public document titled *Histoplasmosis – Protecting Workers at Risk*).
- 5.2 All workers shall wear disposable protective clothing (Tyvek® coveralls). Disposable overalls with hoods shall be donned when working in areas where *H. capsulatum* spore-contaminated material is likely to fall from overhead.
- 5.3 All workers shall wear disposable shoe coverings fitted with ridged soles made of slip-resistant material to reduce the likelihood of slipping on wet or dusty surfaces. Gloves shall be worn.
- 5.4 All workers shall wear a full facepiece air purifying respirator fitted with P100 (HEPA) cartridges. If entering an enclosed area in which the extent of excrement contamination is unknown, additional protective measures shall be taken such that workers shall wear a powered air-purifying respirator (APR) with full facepiece fitted with P100 (HEPA) cartridges. Any variance from these requirements must be approved by the Region Safety, Health and Environment Manager. Workers donning APRs shall be medically screened, cleared, and trained in their proper use in accordance with AECOM safety program standards.
- 5.5 If contaminated material must be disturbed for purposes of removal/disposal or during the structure inspect process, it shall be wetted down prior to all work and will be rewetted as necessary to minimize airborne dusting.
- 5.6 After working in *H. capsulatum* spore-contaminated areas and before removing any respiratory protective equipment, workers shall remove all protective clothing and shoe coverings and seal them in a heavy-duty plastic bag for disposal.
- 5.7 Workers shall observe a high degree of personal hygiene, even if the exposure is casual. Special care shall be taken to wash hands, face, and other areas of exposed skin thoroughly before eating, drinking or smoking.

Americas

Large Carnivores & Ungulates

S3NA-313-ATT9

1.0 Hazard

- 1.1 Most wild carnivores in the feline family (cougars, lynx, and bobcat) or the canine family (wolves and coyotes) are more predictable than bears and are not predatory towards humans; however, all wild animals can be dangerous if they feel threatened or if they are sick or starving.
- 1.2 Most ungulates (deer, moose, elk, and caribou) will avoid humans and will flee as soon as a human is sighted; however, females with young (during May and June) and males during the mating season (September to November) can be very aggressive, especially if provoked.

2.0 Personal Protective Equipment

- 2.1 Noise makers such as bear bangers, whistles and bells can be used as deterrents for an approaching animal.
- 2.2 Pepper (bear) spray can be used to ward off an imminent attack.

3.0 Safe Work Practice

- 3.1 Most negative encounters with ungulates or carnivores can be avoided with a few key preventative measures:
 - 3.1.1 When working in wilderness isolation, always travel in pairs and make lots of noise.
 - 3.1.2 Always store food in air-tight containers away from sleeping areas (if camping) and never carry strong smelling foods which could attract animals.
 - 3.1.3 Keep your eyes open for fresh animal signs which may indicate a dangerous situation:
 - Extensive fresh rubbing on branches in the fall might indicate the presence of a rutting male ungulate that may become aggressive to defend a potential mate.
 - A fresh kill or carcass which might indicate the presence of a carnivore that may become aggressive to defend its food.
- 3.2 Maintaining a distance of at least 100 feet (30 meters) allows large animals an escape route. If you notice any signs of aggression or behavioral changes, you should move away to a safe location. Wildlife should not be enticed by reaching out or simulating calls.
- 3.3 Pets should be kept secure and away from wildlife as their actions can provoke an attack. Moose, deer and other wildlife may appear quite docile; however, if a dog makes them feel threatened, their behavior can become unpredictable.
- 3.4 **If you are approached by a carnivore (wolf, coyote, or cougar):**
 - 3.4.1 Pick up small children immediately.
 - 3.4.2 Try to appear bigger, hold your arms or an object over your head.
 - 3.4.3 Face the animal and retreat slowly. Do not run or play dead.
 - 3.4.4 Maintain steady eye contact with the animal.
 - 3.4.5 If the animal continues to approach, deter an attack by yelling, waving a stick or throwing rocks.
 - 3.4.6 If you are attacked, fight back. Hit the animal with a heavy stick or rock.
- 3.5 **If you are approached by an ungulate (moose, elk, deer, bison or caribou):**
 - 3.5.1 An angry moose, elk or deer will face you with its head and ears lowered.

- 3.5.2 Back away slowly.
- 3.5.3 Look for something to get behind like a tree or a car. You can go faster around an obstacle than the ungulate can.
- 3.5.4 An ungulate is more likely to bluff charge but if it continues the charge and you are attacked in the open, curl up in a ball on the ground. Always protect your head with your arms and lie still.
- 3.5.5 Stay still after the attack until the ungulate moves away.

Bear Safety

S3NA-313-ATT10

1.0 Hazard

- 1.1 An encounter with a bear of any species can have a wide variety of outcomes, ranging from a simple sighting, to a false charge, to a serious mauling or even death. Consequently, the risk of a bear encounter must be taken very seriously.
- 1.2 The hazard or risk associated with a bear encounter varies significantly depending on the location. It is important to research the project area before field work commences to determine the expected probability of encountering a bear. Remoteness from urbanized areas should not be a criterion, as bears have been encountered within city limits, especially near landfills.
- 1.3 The risk associated with a bear encounter also varies with the species of bear, the season, and the circumstances under which the bear is encountered.
- 1.4 Preparing staff for any type of encounter is key to managing the risk.

2.0 Personal Protective Equipment

- 2.1 The best deterrent of a “bad bear encounter” is knowledge: a good understanding of the ecology and the behavior of the bears that will likely be encountered.
- 2.2 Bear Spray and Bear Bangers
 - 2.2.1 Staff must have hands-on training for the safe use of bear spray (a pre-season practice run is a good use of expired bear spray).
 - 2.2.2 Prior to work commencing, staff must ensure that the bear spray they are carrying is still valid and not past its expiration date.
 - 2.2.3 During travel, bear spray must be sealed in an airtight container or bag and must not travel in the cab of a vehicle, aircraft, or helicopter.
- 2.3 Firearms
 - 2.3.1 Environments and conditions which pose a high risk of bear encounters, may warrant the use of an armed wildlife monitor. Project managers, in consultation with appropriate project staff and Safety, Health and Environment Management, are responsible for determining the level of risk for their projects and whether or not such measures are required.
 - 2.3.2 A person hired as an armed bear monitor must be properly trained in wildlife monitoring as well as certified in the expert usage of firearms.
 - 2.3.3 The usage of an armed bear monitor is intended only as an additional precautionary measure to be used in specific environments to ensure the protection of field staff; staff should still be equipped and trained appropriately for the risk.

3.0 Restrictions

- 3.1 Staff must not work alone in areas where there is a medium or high risk of a bear encounter.
- 3.2 AECOM personnel shall not carry firearms or attempt to function as a wildlife monitor and/or perform their professional duties. For possible exceptions contact the Regional SH&E Manager who will evaluate the potential hazards with Regional Manager and Legal and provide written response. This can only be overridden with expressed permission of Region Executive and AECOM Chief Resilience Officer, refer to *WP-001-PR Firearms Standard*.

4.0 Training

- 4.1 In-house Bear Awareness training must be taken by all field staff who work in bear country every three years at a minimum, or more often as required.
- 4.2 The Bear Awareness training involves testing and improving the employee's knowledge about bear encounters, watching videos regarding bear awareness and behavior, and participating in group discussions about how to avoid and how to respond to bear encounters.
- 4.3 Specific considerations are given to black bear, grizzly bear, and polar bear encounters.

5.0 Safe Work Practice

- 5.1 Staff must be aware of wildlife signs and avoid wildlife encounters.
- 5.2 Bear Signs
 - 5.2.1 Fresh tracks – It is often better to see the bear's tracks than to see the actual bear. If you can tell the direction that the bear is travelling in, it is prudent to change your course of direction. Bears will travel down the same pathways people or other large animals use. If you have a clear track you can determine which type of bear has passed through the area. If you see more than one track, you can tell that it is possibly a female with cubs. Avoid females with cubs!
 - 5.2.2 Scat – Bear scat will look different depending upon the bear's diet. Close examination of bear scat can sometimes give you an indication of what the bears have been eating at that time of year. If the scat contains remnants of human garbage, there is a human food conditioned bear in the area. These bears associate people with food and can be the most dangerous type of bear to encounter.
 - 5.2.3 Animal carcasses – IF YOU COME ACROSS A CARCASS, LEAVE THE AREA IMMEDIATELY. Grizzly bears will often cover their kills for a few days and let it rot, then come back and eat it. THE BEAR WILL STAY CLOSE BY. Grizzly bears will defend their kill and this is a situation that could prompt a defensive attack by a bear.
 - 5.2.4 Torn-up logs and stumps – Bears will forage for insects in dead logs and rotting trees. You will often see torn up logs and stumps, evidence of their foraging.
 - 5.2.5 Evidence of digging – Holes dug into the ground are often made by grizzly bears digging for roots or ground squirrels. In particular, grizzlies will dig for food in the early spring soon after they leave their dens.
 - 5.2.6 Claw marks on trees – Claw marks can be left on trees by black bears when they have climbed up a tree. Grizzly bears will also leave claw marks on trees and on the ground. Bears will often chew a small tree or a sign-post, so watch for signs of chew marks along the trail.
 - 5.2.7 Hair on trees – Bears will rub against trees, usually trees with rough bark, to scratch themselves. You can find evidence of bears by the hair left in the tree's bark. The higher the hair left on the tree, the bigger the bear. Remember that the bear will often stand on its back legs to scratch its back on the tree.
 - 5.2.8 Daybeds – Bears will be most active in the early morning and in the evening. It would be prudent for field staff to restrict their field activities during the bear's most active foraging times as much as possible. During the heat of the day, bears will rest in daybeds. These can be shallow depressions of piled up leaves in the forest, trampled vegetation, a shallow scrape or a hole. Daybeds are usually located in cool places. Bears will make daybeds along streams and rivers. Daybeds are often associated with feeding places and therefore should be avoided.

5.3 Prevention

5.3.1 Your best defense against bears is to actively practice bear avoidance techniques when working in the field. You can prevent chance encounters by taking the following precautions:

- Know the areas and habitats bears use at different times of the year, and attempt to avoid such areas or be extremely cautious if you have to travel through them.
- Contact the local Fish & Wildlife Office to get current information on the bears in the area. Ask what other camps are in the area and if they are following good bear avoidance practices. (i.e., do they keep a clean camp?) If there are nearby human food sources available, e.g., an open dumpsite, the local bears may not be afraid to approach your camp.
- Always be aware of your surroundings. Stay alert. Watch for signs of bears along your route.
- Use binoculars to look around for bears when you are in open terrain.
- Never approach a bear if you see one feeding in the distance.
- Note the behavior of other wildlife in the area. Flocks of ravens can alert you to a possible animal carcass, and perhaps a bear. The area should be avoided. Bird or squirrel alarm calls might be telling you that a bear is near.
- Whenever possible, travel in daylight and try to avoid areas with restricted visibility, e.g., dense brush.
- Make lots of noise, especially when travelling in dense vegetation. Sing, shout, or talk loudly. You can carry portable air horns or cans of rocks. (Please note that bear bells are not effective – they do not make enough noise to warn a bear that you are approaching. You need to be loud so the bear can hear you coming.) Remember that the noise you make can be masked by loud natural sounds such as the wind or water. Therefore it is possible that the noise you make can go unnoticed by a bear whose attention is focused on feeding. You must make every attempt not to surprise a bear. In areas of loud natural noise, be louder!
- Stay together and travel in groups. Bears are less likely to attack groups of people. When travelling in groups, stay close together. Being in a group doesn't help if the individuals have spread apart along the trail.
- Pets should not accompany you when you are travelling in bear country. If you must take your pet, keep the animal on a short leash at all times. Unleashed dogs will harass bears and once scared, run back to their owner with an angry bear in pursuit.
- Do not wear perfumes or cosmetic products when you are travelling in bear country. Do not mask your human scent.
- All sanitary products should be stored in a similar fashion as food (stored at least 10 feet [3 meters] above site).
- Children should be kept very close by in bear country.
- Carry bear deterrents and know their limitations. Be familiar with how to use the deterrents, how to transport the deterrent safely and under what conditions it is most effective. Carry the deterrent in a belt, out in front and ready to grab at a moment's notice, never in your backpack.

5.4 Field Worker Precautions in Bear Country

5.4.1 Field workers should take extra precautions when working in bear country:

- Make every effort to go out into the field with another person; you should not be working alone in the field. One person can act as a lookout for the other. Keep watch for bear signs.
- Never approach a bear.
- Report where you are going and when you will return every time you leave camp. Have a plan of action if someone does not report back to camp at a specified time.

- Bears do get used to a camp's schedule and you will have fewer surprise encounters if everyone in the camp comes and goes at the same time every day.
- Take a two-way radio with you when you go out into the field.
- Always carry bear deterrents with you in the field and understand each deterrent's limitations. Carry your deterrents on a belt, out in front and ready to use instantly. Do not carry your deterrents in your backpack.
- Keep any food that you take with you sealed in odor-proof/bear-proof containers. Make every attempt to take odorless food with you, not something with a heavy scent.
- Pack out any garbage in odor-proof containers and burn once you return to camp.
- The noise of an ATV or skidoo can scare off a bear. Starting the machine and revving it up can scare off a curious bear. **DO NOT CHASE A BEAR WITH AN ATV OR SKIDOO.** You may need to drive the ATV around in circles to scare off the bear, but do not chase the bear.
- Take extra precautions when travelling along lakes or stream beds; bears use streams and river beds as travel routes. Be sure to carry noise makers.
- Limit your workday so you are not out in the early morning or evening when bears are most likely to be foraging.
- All **employees** should be proficient in First Aid. Do not go out into the field without first aid training.
- All field camps should have a First Aid Kit.
- All field camps should have means of communication with local ambulance or air ambulance personnel.
- A person's best defense against bears is to avoid them. If this is not possible, then being heard, smelled, or seen may lessen your chances of surprising a bear and/or provoking an attack.
- All wildlife should be respected, avoided, and not harassed at any time.
- Cooking in remote areas should be avoided. Any food should be stored in airtight containers and all garbage should be managed appropriately: "pack it in, pack it out".
- A bear in camp or within human structures is not a chance encounter. If this bear challenges you, you must fight, scream, and do whatever is necessary to live, no matter what species the bear is!
- In general, there are two types of bear encounters: Defensive and Non-defensive for grizzly bears and black bears. Your response will vary based on your assessment of the situation (your training will help you in identifying these situations and the appropriate response).

6.0 Encounters

6.1 General Recommendations When Encountering a Bear

- Consider your surroundings and assess the situation before you act.
- Remain calm. Do not turn your back to a bear.
- **DO NOT RUN** – Running may trigger the bear's natural pursuit response. Bears are able to reach speeds of 25 miles per hour [40 kilometers per hour], must faster than Olympic sprinters. Bears are also excellent swimmers.

6.2 Bear Encounters in the Field

- 6.2.1 Your response will depend upon the type of encounter.

- 6.2.2 Bears are more predictable than once believed and you can determine your best course of action in a confrontation by understanding the bear's characteristics and motivation. There are two pieces of information you should be aware of in any bear encounter:
 - The type of bear you are dealing with, and
 - The reason for the encounter.
- 6.2.3 Some people believe that when you stand your ground against a predatory black bear attack, the bear will feel threatened and leave. This has been effective in some cases. HOWEVER, it is not effective against a grizzly bear predatory attack and it is very difficult to know when it will be effective against black bears. Polar bears do not follow the same behavioral patterns as grizzly and black bears; polar bears are almost always aggressive and will not back down. Special considerations must be given to projects where polar bear encounters are anticipated.
- 6.3 If you can leave undetected:
 - 6.3.1 Leave the area quietly in the same direction that you came from.
 - 6.3.2 Move while the bear's head is down. Stop moving when the bear lifts its head to check its surroundings.
 - 6.3.3 Stay downwind so the bear will not pick up your scent.
 - 6.3.4 When you have moved a safe distance away, you can either watch and wait until the bear leaves or make a wide detour around the bear.
 - 6.3.5 If the bear is unaware of you and approaching, allow the bear the right of way.
- 6.4 If you cannot leave undetected:
 - 6.4.1 Let the bear know that you are present by smell first; therefore move upwind so they can pick up your scent.
 - 6.4.2 If it is possible, try to keep the bear in your sight. Watch to see if the bear leaves when it smells that a person is nearby.
 - 6.4.3 Attempt to move out of the way without being noticed by the bear. If you cannot do this, talk loudly to let the bear know where you are.
- 6.5 If the bear is aware of you but in the distance:
 - Remain calm.
 - Continue walking slowly in the same general direction, but head away from the bear.
 - DO NOT RUN.
 - If the bear begins to follow you, drop your pack or some article, (not food) to distract the bear. This may distract the bear long enough for you to escape. If you drop food for the bear – you will help the bear associate food with humans and teach it that aggressive behaviour will be rewarded with food.
 - If it is a grizzly following you, climb a tree if there is a large tree around. Proper escape up a tree would require scrambling at least 33 feet (10 m), however this is applicable only to Grizzly encounters. Black bears are excellent climbers. Tree climbing should be last resort.
- 6.6 If the bear is aware of you and close:
 - A bear will feel threatened in a close confrontation. The bear's natural tendency will be to reduce or to remove the threat. Assist the bear by acting as non-threatening as possible.
 - Do not make direct eye contact with the bear.
 - Do not make any sudden moves.
 - Do not run!

- The bear needs to identify you as a person, so talk in low tones and slowly wave your arms over your head.
- Attempt to give the bear an opportunity to leave. Be sure the bear has an open escape route. Do not corner a wild animal.
- Try to back away slowly and/or climb a tree if appropriate.
- Attempt to deter the bear if you are in a safe position.

6.7 If the bear is close and threatening:

- If you have a deterrent such as a bear banger or bear spray, be prepared to use it depending on how close the bear is. Try to scare the bear off.
- If you do not have a deterrent, or if using the deterrent is not successful, act as non-threatening as possible.
- Talk to the bear in a calm authoritative tone of voice.
- Do not startle or provoke the bear by making sudden moves.
- Never imitate the bear's aggressive sounds, signals or posture. The bear is attempting to establish dominance and imitating its moves is a challenge to its dominance.
- Back slowly away from the bear and drop a pack or some other article in order to distract the bear momentarily.
- Remember that the bear may be defending cubs that you have not yet seen or they have a food cache nearby. Attempt to look as non-threatening as possible.

6.8 If the bear is very close and approaching:

- A distance of less than 164 feet (50 meters) in an open area and closer in a forested area.
- If the bear continues to approach, use your deterrent.
- If the bear does not respond to the deterrent you must now **STAND YOUR GROUND!**
- If the bear continues to approach and is acting aggressive, **YOU MAY HAVE TO SHOOT** if you are carrying a firearm.

6.9 If the Bear Charges:

- A bear will charge you at high speed down on all four legs and often crouched low to the ground.
- Bears do not charge when standing up on the hind legs.
- Many charges are bluffs and the bear will often stop or veer off just at the last minute. It is difficult to know if the bear is bluff charging or not until it gets very close.
- When faced with a charging bear you have two options:
 - Use your bear deterrent; or
 - Roll into a ball and cover your neck and head with your arms if you are unarmed and have no other choice.

Americas**Small Mammals****S3NA-313-ATT11****1.0 Hazard**

- 1.1 Working in the field either directly or indirectly with small mammals has inherent risks of injury or exposure to zoonotic diseases (infectious diseases that can be transmitted from animals to humans) that all field staff need to protect themselves against.
- 1.2 The risks are usually higher when there is direct contact with a wild animal, either through a break in the skin (blood), saliva, or excrement; however, there are also risks through air-borne diseases (e.g., Hantavirus).
- 1.3 Obviously, wildlife biologists directly handling wildlife, dead or alive, or working with wildlife feces or in enclosed habitats (such as caves), have an increased risk of exposure to a wider range of zoonotic diseases and should take extra precautions.

2.0 Personal Protective Equipment

- 2.1 Full-length clothing (long sleeves and pants)
- 2.2 Insect repellent
- 2.3 Respiratory equipment (when directly handling wildlife)
- 2.4 Gloves (when directly handling wildlife)

3.0 References

- 3.1 None.

4.0 Restrictions

- 4.1 Wildlife handling must only be completed under direct supervision of an experienced individual.

5.0 Training

- 5.1 Any staff that will be handling wildlife must be adequately trained and/or supervised by a wildlife biologist experienced in the job task.

6.0 Safe Work Practice

- 6.1 Wild animals can carry a variety of diseases that humans can contract: viral, parasitic, bacterial, and protozoal. Basic Personal Protective Equipment such as full-length clothing, gloves and a respiratory mask will greatly reduce the risk of exposure.
- 6.2 Treat unknown dogs encountered in field activities in the same manner as a wild animal. Be conscious of behaviors that seem to indicate anxiety (tail under the belly), defensiveness or aggressiveness, and attempt to leave the area if these are identified.
- 6.3 Whenever a wild animal must be handled, the procedure must be accomplished as safely and quickly as possible.
- 6.4 Proper techniques must be employed to avoid or minimize the risk of personal injury while, at the same time, avoiding or minimizing injury to the animal.
- 6.5 Gloves, catch sticks, caging, and other appropriate equipment may be necessary when handling a wild animal. Most of these animals will be extremely stressed, resisting every restraint attempt.

- 6.6 In the unfortunate circumstance that a person is bitten or scratched, he or she should cleanse the wound thoroughly with soap and flush with water immediately, providing for a mechanical removal of potentially infective organisms. This should be followed by cleansing under medical supervision and consultation with a physician to consider the potential exposure to the rabies virus.

7.0 Rabies

- 7.1 You will not be able to accurately determine if an animal has rabies simply by observation as traditional symptoms of rabies (foaming at the mouth, biting, etc.) do not occur in all animals nor at all stages. There are some mammals that are at a higher risk than others for the rabies virus, such as raccoons, skunks, stray cats and dogs, foxes, coyotes, rodents, and bats; however, any mammal can contract the virus.
- 7.2 Rabies is contracted by contact of an infected animal's saliva with an open wound – a bite or a scratch.
- 7.3 Symptoms of rabies in humans usually do not present themselves for a minimum of 10 days to a year or longer (the average is 30 to 50 days). Symptoms are typical of a flu, including malaise, loss of appetite, fatigue, headache, and fever. Over half of all patients have pain (sometimes itching) or numbness at the site of exposure. They may complain of insomnia or depression. Two to ten days later, signs of nervous system damage appear; these include hyperactivity and hypersensitivity, disorientation, hallucinations, seizures, and paralysis.
- 7.4 Because rabies is so difficult to detect and positively identify, it is very important to consult a physician immediately. If rabies is a possibility, begin treatment with the rabies vaccine as soon as possible (unlike other vaccines, rabies vaccination begins after exposure because the virus takes a comparatively long time to induce disease).

8.0 Hantavirus

- 8.1 Rodents can carry a variety of diseases; of notable concern is the North American hantavirus which can cause Hantavirus Pulmonary Syndrome (HPS).
- 8.2 A common host of the hantavirus is deer mouse and related species (*Peromyscus* spp.), which are common throughout much of North America.
- 8.3 Although infection is rare, it can be fatal and, therefore, it is necessary that risk of exposure be minimized. Infection can be spread to humans when they:
- 8.3.1 Breathe air contaminated by deer mouse saliva, urine or feces containing infectious hantaviruses; or
 - 8.3.2 Accidentally rub eyes, mouth or broken skin with hantavirus-infected deer mouse saliva, urine or feces.
- 8.4 The following precautions will be taken for all field operations:
- 8.4.1 Limit exposure to soils handling and use gloves where appropriate.
 - 8.4.2 Wash or sanitize hands often throughout the day and before meals.
 - 8.4.3 Equipment bags, storage areas, and vehicles will be inspected daily for signs of deer mouse infestation.
 - 8.4.4 Rodent-proof storage containers will be used when practical.
 - 8.4.5 Do not enter buildings infested with deer mice without adequate respiratory protection.
 - 8.4.6 Droppings should never be removed by vacuuming or sweeping. Wetting down an area with a mixture of 1:9 household bleach and water solution will reduce risk of airborne exposure.
- 8.5 If flu-like symptoms develop three days to six weeks after exposure to rodents, a doctor should be contacted immediately (mechanical ventilation is the primary method of treatment).

9.0 Bubonic Plague

- 9.1 The bacteria that cause plague, *Yersinia pestis*, maintain their existence in a cycle involving rodents and their fleas.
- 9.1.1 In urban areas or places with dense rat infestations, the plague bacteria can cycle between rats and their fleas.
- 9.1.2 Humans may contract the plague bacteria through:
- Infected flea bites.
 - Contact with contaminated fluid or tissue of a plague infected animal.
 - Infectious droplets from an infected person coughing into the air (very uncommon in the United States, but relatively frequent in developing countries).
- 9.1.3 Individuals infected develop sudden onset of fever, headache, chills, and weakness and one or more swollen, tender and painful lymph nodes (called buboes).
- 9.1.4 Immediate medical attention is necessary to prevent complications or death.
- 9.1.5 Rodent control measures should be employed at AECOM locations.
- 9.1.6 Wear gloves if handling potentially infected animals to prevent contact between skin and the plague bacteria. Contact the local health department with and questions about disposal of dead animals.
- 9.1.7 Repellent shall be used if there is potential exposure to rodent fleas. Products containing DEET can be applied to the skin as well as clothing and products containing permethrin can be applied to clothing (always follow instructions on the label).

Snakes & Scorpions

S3NA-313-ATT12

1.0 Hazard

- 1.1 Snakes have the ability to inject venom. A bite from a venomous snake, which may inject varying degrees of toxic venom, is rarely fatal but should always be considered a medical emergency.

2.0 Personal Protective Equipment

- 2.1 Long pants and shirts
- 2.2 Heavy gloves if staff will be handling debris or be close to the ground
- 2.3 Rubber boots, or boots that fully cover the foot (not sandals!) and preferably are at least 10 inches (25 centimeters) high
- 2.4 Snake Chaps that cover at least the shin
- 2.5 Personal first aid kit

3.0 Restrictions

- 3.1 Staff must not work alone in areas where the risk of a snake encounter is high.

4.0 Safe Work Practice




- 4.1 Prior to going into the field, staff should research the area and identify what species are present. Once confirmed, staff should contact local hospitals to identify which carry anti-venom and include that information into the SH&E Plan and THA.
- 4.2 Staff working in areas known to be inhabited by venomous snakes should take extra precautions, be able to identify the local snake species, and understand the best practices for administering first aid.
- 4.3 Most snakes in Canada are non-venomous; and most snake bites are not fatal, only painful. Learning to identify snake species will assist you in responding appropriately to an encounter, and will assist medical professionals in determining if antivenin needs to be administered if anyone is bit.
- 4.4 Most snakes are non-aggressive and will only attack if immediately threatened.
- 4.5 Prevention
 - 4.5.1 Before venturing out into the wilderness, familiarize yourself with the snakes in your area, both venomous and non-venomous species.
 - 4.5.2 Learn which habitats the venomous species in your region are likely to be encountered in, and use caution when in those habitats.
 - 4.5.3 Try as much as possible not to take a snake by surprise.
 - 4.5.4 Stay on trails where possible, and watch where you place your hands and feet, especially when climbing or stepping over fences, large rocks, and logs, or when collecting firewood. Take care when overturning any objects on the ground when in snake country.
 - 4.5.5 If you see a snake, give it as much room as possible. Most snakes have a strike distance that is only half the length of their body.
 - 4.5.6 If you get very close to a rattlesnake, hold very still until it calms down and starts to move away. Then slowly move backwards until you are at least one snake-body length away.

4.6 Treatment


- 4.6.1 A bite from a venomous snake should be considered a major medical emergency. Emergency services should be contacted immediately and staff should follow the direction of the medical responders.
- 4.6.2 Try to keep the snakebite victim still, as movement helps the venom spread through the body.
- 4.6.3 Keep the injured body part motionless and just below heart level.
- 4.6.4 Keep the victim warm, calm, and at rest, and transport him or her immediately to medical care.
- 4.6.5 Do not allow him to eat or drink anything.
- 4.6.6 If medical care is more than half an hour away, wrap a bandage a few inches above the bite, keeping it loose enough to enable blood flow (you should be able to fit a finger beneath it). Do not cut off blood flow with a tight tourniquet. Leave the bandage in place until reaching medical care.
- 4.6.7 Identify the snake that caused the bite to determine if it is venomous, and if antivenin needs to be administered. Do not waste time or endanger yourself trying to capture or kill it. Note the shape and color of the snake's head.
- 4.6.8 If you are alone and on foot, start walking slowly toward help, exerting the injured area as little as possible.
 - Note that there are several species of snakes that superficially resemble rattlesnakes. Several species, including Bull, Milk, Fox, and Rat Snakes will even rattle their tails when startled.
 - Massasauga Rattlesnake is recognized as a Threatened Species in Ontario and it is an offence to harass, or destroy the habitat of this species.
- 4.6.9 Workers in scorpion habitat have the potential to be stung.
 - Scorpions usually hide during the day and are active at night. They may be hiding under rocks, wood, or anything else lying on the ground. Some species may also burrow into the ground. Most scorpions live in dry, desert areas. However, some species can be found in grasslands, forests, and inside caves.
 - Scorpions are found in Southern and Southwestern United States.
 - One scorpion species, the Northern Scorpion (*Paruroctonus boreus*) occurs in semi-arid areas of southern British Columbia, Alberta, and Saskatchewan. It carries a stinger on the end of its tail. The sting is painful but not life threatening unless there is an allergic reaction.
 - Workers should wear long sleeves and pants. Clothing and shoes should be shaken out before put on.
 - Symptoms of a scorpion sting may include:
 - A stinging or burning sensation at the injection site (very little swelling or inflammation)
 - Convulsions
 - Staggering gait
 - Slurred speech
 - Drooling
 - Muscle twitches
 - Abdominal pain and cramps
 - Scorpion stings may be painful, but most are harmless. In the United States, only the Bark Scorpion has venom that can potentially cause severe symptoms.
 - Scorpions capable of lethal stings are found predominantly in Mexico and South America.
 - If there is any question as to what type of scorpion caused the sting, contact medical services immediately.




5.0 Species

5.1 Venomous Snakes in Canada

<p>Eastern Massasauga Rattlesnake (<i>Sistrurus catenatus</i>) found around Wainfleet, Windsor, Bruce Peninsula and eastern Georgian Bay in Ontario.</p>	 <p>Eastern Massasauga Rattlesnake picture by Michael Redmer/Courtesy Lincoln Park Zoo</p>
<p>Northern Pacific Rattlesnake (<i>Crotalus viridis</i>) found primarily in Okanagan and Thompson River valleys of southern British Columbia.</p>	 <p>LANCE TANNAHILL 2000</p>
<p>Prairie Rattlesnake (<i>Crotalus viridis</i>) found in south eastern Alberta, and south western Saskatchewan.</p>	

5.2 Venomous snakes in the United States

<p>Rattlesnake(<i>Crotalus cerastes</i>) found mostly concentrated in the southwestern United States, they extend north, east and south in diminishing numbers and varieties. Every contiguous state has one or more varieties of rattlesnake.</p> <p>The rattlesnake is found in many different biomes ranging from along the coast at sea level, the inland prairies and desert areas to the mountains at elevations of more than 10,000 feet.</p> <p>Species include: Sidewinder, Santa Catalina, Western,</p>	 <p>Western Rattlesnake</p>
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<p>Mojave, Red Diamond, Western Diamond, Ridge Nosed, Eastern Diamondback, and Pigmy.</p>	 <p>Eastern Diamondback</p>
<p>Copperhead (<i>Agkistrodon contortrix</i>) is the most common venomous snake found in the eastern United States. It can be found in the states of Texas, Oklahoma, Kansas, Missouri, Arkansas, Louisiana, Mississippi, Alabama, Georgia, Florida, South Carolina, North Carolina, Tennessee, Kentucky, Virginia, Illinois, Indiana, Ohio, Iowa, Pennsylvania, Maryland, New Jersey, Delaware, New York, Connecticut, and Massachusetts.</p>	
<p>Cottonmouths (water moccasins) (<i>Agkistrodon piscivorus</i>) found in the eastern United States from Virginia, south through the Florida peninsula and west to Arkansas, eastern and southern Oklahoma, and east and central Texas.</p>	
<p>Coral Snake (<i>Micrurus sp.</i>) found in the southern range of many temperate United States including North Carolina, Georgia, Alabama, Mississippi, Louisiana, Texas, Arkansas, Kentucky, Arizona, and New Mexico.</p>	 <p>Eastern Coral Snake, <i>Micrurus fulvius</i></p>

Drilling, Boring & Direct Push Probing

S3AM-321-PR1

1.0 Purpose and Scope

- 1.1 This document provides procedures designed to help prevent injuries to personnel working on the project and pedestrians, property damage, and adverse environmental impact as a result of potential hazards associated with drilling, boring and direct-push probing. These hazards include, but are not limited to, encountering underground utilities, subsurface installations, rotating equipment and potential overhead hazards.
- 1.2 This procedure provides the minimum requirements to be followed when drilling, boring, and probing work are performed.
- 1.3 This procedure applies to all Americas-based employees and operations.
- 1.4 The Manager is responsible for meeting all the requirements in this procedure.
- 1.5 AECOM's clients may have specific procedures which shall be followed to identify and map utility and subsurface structures on their properties or facilities. Provided the client's procedures meet or exceed those of AECOM, approval shall be obtained from the Manager and the SH&E Manager to follow the client's procedures.

2.0 Terms and Definitions

- 2.1 **Underground Utilities** – All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling, and communications, etc.
- 2.2 **Ground Disturbance (GD)** – Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.
- 2.3 **Intrusive Activities** – Examples: Excavation of soil borings, installations of monitoring wells, installation of soil gas sampling probes, excavation of test pits / trenches or other man-made cuts, cavity, trench, or depression in an earth surface formed by earth removal.
- 2.4 **Subsurface Installations** – Examples: Subterranean tunnels, underground parking garages, and other structures beneath the surface.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-118-PR1 Hearing Conservation
- 3.3 S3AM-208-PR1 Personal Protection Equipment
- 3.4 S3AM-209-PR1 Risk Assessment & Management
- 3.5 S3AM-213-PR1 Subcontractor Management
- 3.6 S3AM-305-PR1 Hand & Power Tools
- 3.7 S3AM-306-PR1 Highway and Road Work
- 3.8 S3AM-322-PR1 Overhead Lines
- 3.9 S3AM-322-FM1 Overhead Electrical Lines Acknowledgement
- 3.10 S3AM-325-PR1 Lockout Tagout
- 3.11 S3AM-326-PR1 Machine Guarding
- 3.12 S3AM-331-PR1 Underground Utilities

3.13 S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager

- Confirm the development of the project SH&E Plan and compliance with this procedure.
- Confirm the appropriate equipment and materials are available to conduct the drilling, boring or direct-push operations.
- Confirm compliance with *S3AM-331-PR1 Underground Utilities*.
- Review the *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* prior to authorizing work to proceed.
- Confirm that employees conducting drilling, boring or direct-push probing possess any required training, registrations or certifications.
- Confirm all employees involved and affected by the task review the SH&E Plan, *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* and Task Hazard Assessment (THA) prior to work commencing.
- Confirm an equipment maintenance inventory is maintained, schedules adhered to and appropriate inspections of equipment are conducted.
- Provide authorization (with the concurrence of the Site Supervisor and SH&E Manager) for work to resume if interrupted due to unexpected conditions or events.

4.1.2 Safety, Health & Environment (SH&E) Manager

- Assist AECOM management as needed by providing guidance and clarification as to issues that may arise.
- Review the project SH&E Plan to confirm compliance with jurisdictional regulations. Provide technical guidance as needed when a variance is pursued related to this procedure. Confirm variance process meets requirements identified in *S2-001-SM1 Global SH&E Management System Manual*.

4.1.3 Employees

- Maintain training as appropriate to the work to be completed (e.g., ground disturbance, lockout tagout, equipment operation, etc.). Refer to *S3AM-003-PR1 SH&E Training*.
- Review the SH&E Plan, *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* and Task Hazard Assessment (THA) prior to work commencing.
- As appropriate to the anticipated or encountered hazards and as addressed in the applicable planning documentation, utilize appropriate personal protective equipment (PPE) and applicable training, practices and operating procedures.
- Immediately notify the Manager of any unanticipated conditions or events. If assigned equipment, perform appropriate inspections and confirmations of maintenance and / or repairs.

4.2 Training

- 4.2.1 All on-site employees involved with drilling, boring, and direct-push probing shall be trained, at a minimum, in these procedures and in the procedures of *S3AM-331-PR1 Underground Utilities*.
- 4.2.2 All operators and assistants shall have the appropriate safety training based on the SH&E Training Matrix and any additional training assessments developed at the business group, and be versed in the equipment to be utilized.
- Refer to *S3AM-003-PR1 SH&E Training*.

- This training may include, but is not limited to, Excavation / Trenching (Ground Disturbance), HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.
 - Only qualified personnel shall operate and inspect equipment.
- 4.2.3 All on-site Employees involved with drilling, boring, and direct-push probing activities shall be provided with on-site orientation of the drill rig and its operation.
- 4.2.4 All Employees involved with drilling, boring and direct-push probing activities at a client site shall receive the applicable client-required training.
- 4.3 Planning
- 4.3.1 SH&E Plan – At a minimum, a SH&E plan that includes a pre-job hazard assessment shall be prepared and communicated to all involved personnel prior to any drilling, boring, and direct-push probing activities. Refer to *S3AM-209-PR1 Risk Assessment & Management*.
- Assessment shall include both overhead and subsurface utilities and installations. Refer to *S3AM-322-PR1 Overhead Lines* and *S3AM-331-PR1 Underground Utilities*.
 - The SH&E Plan will address any required environmental monitoring including gas monitoring, dust, noise, metals, radiation or other monitoring as may be appropriate for site conditions.
 - All SH&E Plan requirements will be followed by the project team.
 - The location specific emergency response plan shall be in place, contain procedures applicable to the potential emergencies presented by the operations, and be reviewed with all personnel potentially affected.
- 4.3.2 A Task Hazard Assessment (THA) shall be completed before every assigned task at the work location. The focus of the analysis shall be on the specific assigned task and the evaluation of risks and assignment of control measures based on actual work conditions.
- 4.3.3 *S3AM-321- ATT2 Pre-Drilling, Boring & Direct-Push Probing Flow Chart* summarizes the key Pre-Drilling, Boring, and Direct-push probing requirements addressed in this procedure.
- 4.3.4 Procedures and documentation as detailed in *S3AM-322-PR1 Overhead Lines* and *S3AM-331-PR1 Underground Utilities* shall be completed prior to any intrusive subsurface work.
- The locations of subsurface and overhead utilities and subsurface installations will be investigated, documented, mapped on a site plan and evidenced with appropriate surface markings.
 - A site walk shall be conducted by the project team / site Manager and any other appropriate personnel, with the objectives of reviewing all planned intrusive activity locations, the locations of subsurface and overhead utilities and the potential for subsurface installations, to determine the appropriate utility clearance activities, and to observe other physical hazards.
 - All proposed subsurface activities will be reviewed in comparison to subsurface and overhead utilities and subsurface installations and adjustments made as necessary.
 - Appropriate clearance activities shall confirm location(s) of identified underground utilities and subsurface structures. Review the applicable completed *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist*.
 - Site Walks should be repeated as necessary following the clearance of subsurface utilities and installations to confirm hazards are clearly identified.
- 4.3.5 Confirm drilling location(s) and / or bore entry and bore exit points are adequately identified on the worksite to enable appropriate equipment positioning.
- 4.4 Permits, Notifications and Access Agreements

- 4.4.1 Any required notifications shall be provided within the appropriate timeframe to the applicable organization (e.g. owner, agency, governing body, etc.).
- 4.4.2 All applicable permits (e.g. client, government, working near rail road, etc.) will be identified, obtained, and adhered to.
- 4.4.3 Access agreements will be obtained and adhered to as necessary.
- 4.5 Pre-Qualifying and Re-Qualifying Drilling Subcontractors
 - 4.5.1 All drilling subcontractors will be properly pre-qualified in accordance with *S3AM-213-PR1 Subcontractor Management*.
 - 4.5.2 The qualifications of the drilling crew performing the work will be evaluated prior to each mobilization and each day by AECOM's on-site representative to assure that their safety performance, training, qualifications, equipment, processes, and approaches reflect AECOM standards for excellence.
 - 4.5.3 All drilling subcontractor equipment will be properly maintained and properly equipped, and the drilling subcontractor will verify their equipment is fully functional as a normal part of their daily and pre-work routine. Refer to *S3AM-321-FM1 Daily Drilling, Boring & Direct Push Equipment Inspection*.
- 4.6 General Health and Safety
 - 4.6.1 Personal Protective Equipment – Refer to the *S3AM-208-PR1 Personal Protection Equipment* for best practices. These requirements may be modified or expanded in the SH&E Plan. Clothing shall be close fitting and comfortable without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the rig.
 - Depending upon the hazards present, additional PPE may be required such as fire retardant clothing, specific hearing protection, respiratory protective equipment and chemical protective clothing.
 - If the location has potential for underground electrical utilities to be present, workers shall ensure footwear has additional protection of shock resistant soles required (white rectangle with omega symbol).
 - 4.6.2 Hearing Conservation – Hearing conservation program requirements may apply when working around operating equipment. Refer to *S3AM-118-PR1 Hearing Conservation*.
 - Each worker shall wear noise-reducing ear protectors around operating equipment or during elevated noise levels. Distance from the elevated noise level is the primary measure of control for non-essential drilling personnel.
- 4.7 Drilling, Boring and Direct Push Equipment Maintenance and Inspections
 - 4.7.1 All equipment will be inspected prior to the initiation of operations and daily during operations using the *S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection*. This inspection is the responsibility of the operator who will provide written documentation of the inspection prior to the start of drilling each day.
 - Equipment that is deemed defective will immediately be repaired by a qualified person, or, if repair is not practicable, tagged "Out of Service" and sent for repairs or discarded.
 - 4.7.2 Managers shall confirm an accurate inventory of the equipment within their operation requiring scheduled maintenance is developed. Using applicable regulations, industry standards, best practices, and manufacturer's recommendations, a maintenance schedule shall be developed with defined responsibility, required actions, and frequency. Refer to *S3AM-321-FM2 Drilling, Boring, & Direct-Push Equipment Maintenance Inventory*.
 - 4.7.3 The maintenance program for equipment shall:

- Adhere to applicable regulations, standards, and manufacturers' specifications;
- Provide for service by appropriately qualified maintenance personnel; and,
- Require maintenance schedules and records of maintenance.

4.7.4 Employees or operators who are assigned equipment are required to review maintenance schedules for that equipment and will confirm that required maintenance has occurred or see that it is undertaken.

4.8 General Requirements

4.8.1 Excluding geoprobe activities, set up any sample tables and general work areas for employees at a safe distance from the rig.

- The recommended safe distance is the height of the fully extended mast plus 5 feet (1.5 meters), and no less than 30 feet (9.1 meters) from the rig.
- An increase to this distance may be required due to noise exposure hazards. Refer to *S3AM-118-PR1Hearing Conservation*.

4.8.2 Operation of the drilling, boring or direct-push equipment shall be restricted to the designated operator except to activate the emergency shut-off as required.

- All rotary drilling equipment shall have an emergency shut off / kill switch. The location of the switch and operation should be reviewed with all involved Employees.

4.8.3 Sit-on direct push rigs are not permitted on AECOM worksites unless the rig has been modified (in accordance with manufacturer's requirements) to be operated by remote control or the rig has been manufactured with a rollover protection system and seat belt.

4.8.4 Consult jurisdictional regulations as use of J-hooks and cat-heads may be prohibited. Examples:

- 29 CFR 1926 requires derricks and cranes to use hooks with self-closing latches and permits the use of J-hooks only for a task unrelated to this procedure (setting trusses).
- British Columbia and Saskatchewan prohibit the use of friction cat-heads.

4.9 Identifying the Work Area

4.9.1 Ensure the work area is adequately identified:

- Including zone around the drilling, boring, or direct push equipment, as well as fluid equipment, entry point, exit point and any excavated areas.
- Utilize barricades, signage, pylons, snow fence, etc. as appropriate.
- Implement traffic control as necessary.
- Coordinate with concurrent operations to identify their associated hazards and controls, and communicate those associated with AECOM tasks.

4.9.2 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passer-by pedestrians (refer to *S3AM-306-PR1 Highway and Road Work*).

4.9.3 All traffic control devices shall be installed, placed, and maintained in accordance with a Traffic Control Plan, client specifications, and / or the Manual of Uniform Traffic Control Devices and Manual of Uniform Traffic Control Devices for Canada in Canada. Traffic control devices shall consist of and not be limited to

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.

4.10 Clearing Work Areas

- 4.10.1 In addition to any minimum requirements the drilling subcontractor may have, prior to set up, adequate site clearing and leveling shall be performed to accommodate the rig and supplies and provide a safe working area.
- 4.10.2 Clearing the site includes clearing the intended drilling area obstacles and of underground utilities in accordance with *S3AM-331-PR1 Underground Utilities*.
- 4.10.3 Drilling or probing shall not commence when tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.
 - The cleared / levelled area should be large enough to accommodate the rig and supplies.
 - If the rig is positioned on a steep grade and levelling of the ground is impossible or impractical, the wheel of the transport vehicle shall be blocked and other means employed of preventing the rig from moving or toppling over.
- 4.11 Drilling Activities
 - 4.11.1 Federal / State / Provincial / Territorial regulations that govern drill rig operations and exposed moving parts shall be adhered to.
 - 4.11.2 All applicable client on-site safety procedures shall be understood and adhered to.
 - 4.11.3 Minimum approach distances (MAD) from subsurface and overhead utilities and subsurface installations will be established including 5 feet (1.5 meters) from any subsurface utility, 7 feet (2.1 meters) from the pad surrounding any underground storage tanks, and 10 feet (3 meters) from any overhead energized electrical line (or further depending on line voltage). These approach distances are a minimum; government regulations and utility requirements may dictate a greater set back distance and should be confirmed.
 - 4.11.4 Verify that equipment / energy is isolated when lockout is required:
 - Refer to operator's manual and *S3AM-325-PR1 Lockout Tagout*.
 - Ensure stop switch is activated.
 - Driller is out of the seat.
 - Test controls to ensure they do not engage.
 - 4.11.5 In addition to any identified minimum requirements (as applicable, client, drilling subcontractor), the following safety measures shall be taken during drilling, boring or probing operations on site:
 - The operator and helper shall be present during all active rig operations.
 - Site personnel shall remain within visual contact of the rig operator.
 - Hard hats, approved safety boots, safety glasses, and hearing protection shall be worn in the work zone (minimum, the radius around the rig equal to the height of the drill rig mast) of a rig.
 - Gas monitoring shall be conducted as appropriate.
 - Hands, feet and other body parts shall be kept away from moving parts, (e.g. hoisted, rotating, pushing, etc.) including augers, drill rods and reamers.
 - When observing drilling, stand upwind of the drill rig to prevent potential exposure to vapors that may be emitted from the borehole.
 - The emergency shut-off switch on the rig shall be identified to site personnel and tested on a daily basis by the operator.
 - Unauthorized personnel shall be kept outside of the established work zone.
 - Rig crew and other worksite personnel shall not use a cell phone while operating the drill rig or other equipment or within the rig work zone.
 - Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
 - Before raising the mast (derrick) look up to check for overhead obstructions. Refer to *S3AM-322-PR1 Overhead Lines*.

- Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first levelled and stabilized with levelling jacks and / or solid cribbing.
 - The drill rig shall be releveled if it settles after initial set up.
 - Lower the mast (derrick) only when the levelling jacks are down, and do not raise the levelling jack pads until the mast (derrick) is lowered completely.
- After the rig has been positioned to begin drilling, all brakes and / or locks shall be set before drilling begins.
- The operator of a rig shall only operate a drill rig from the position of the controls. The rig shall not be in operation if the operator of the rig leaves the area of the controls.
- Throwing or dropping tools shall not be permitted. All tools shall be carefully passed by hand between personnel or a hoist line should be used.
- If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area.
 - Exhaust fumes can be toxic and some cannot be detected by smell.
 - Air monitoring and, as necessary, noise monitoring shall be conducted.
- Clean mud and grease from boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes shall be covered, protected, or backfilled adequately and according to Federal / State / Provincial / Territorial or local regulations on completion of the drilling project.
- When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending and descending. Always use adequate fall protection and a full body harness when climbing above 6 feet (1.8 meters) of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

4.12 Drilling Fluid

- 4.12.1 Ensure drilling fluid is appropriate to the soil type and conditions to be encountered to enable smooth drilling.
- 4.12.2 Drilling fluid used in the boring process shall be contained at the entry and, as applicable, exit locations until recycled or removed from the site.
- 4.12.3 Confirm drilling fluid does not enter roadways, streams, municipal storm or sanitary sewer lines, and / or any other drainage system or body of water.
- 4.12.4 Monitor drilling equipment and fluid equipment for any leakage or spills. Confirm appropriate containment is in place and adequate spill response supplies are available.
- 4.12.5 It is important to monitor fluid flow and pressure gauges when drilling with any tooling, but it is essential when drilling with a mud motor (pump placed in the drill string to provide additional power to the bit while drilling).

4.13 Unanticipated Concrete / Debris or Void

- 4.13.1 The presence of subsurface installations and utilities requires special care when obstructions / refusal and voids are encountered and when unexpected absence of soil recovery occurs during

drilling operations. Other indicators of subsurface installations and utilities are the presence of warning tape, pea gravel, sand, non-indigenous material, bentonite, red concrete (indicative of electrical duct banks) and any departure from native soil or backfill.

- 4.13.2 If unanticipated concrete / debris is encountered and / or if a void is encountered, drilling will be immediately discontinued and the Manager notified. Drilling may only proceed with Manager or SH&E Manager approval.

4.14 Use of Manual Slide Hammer

- 4.14.1 The following health and safety procedures should be followed when using a manual slide hammer to install shallow injection points, drive point piezometers, and drill tools:

- Only use a manual slide hammer that either attaches directly to the point / piezometer being driven or that incorporates a cap on the point / piezometer / drill tool that prevents the slide hammer from slipping off the point / piezometer / drill tool.
- Always grasp the manual slide hammer (handles if equipped with handles) with both hands while driving the point / piezometer / drill tool.
- Never allow hands or feet to get between the manual slide hammer and the drive plate or anvil.

4.15 Use of Augers

- 4.15.1 The following general health and safety procedures should be followed when supervising borings with continuous flight hollow-stem augers:

- Never place hands or fingers under the bottom of an auger section when it is being hoisted over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When augers are rotating, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from a rotating auger. Never use hands or feet to move cuttings away from a rotating auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.
- Loud noises may occur while driving split spoons. At minimum hearing protection shall be worn when driving split spoons.
- When pulling / lifting augers, a clevis pin or other closed device shall be used. Use of J-hooks is prohibited.

4.16 Attaching and Breaking Rods

- 4.16.1 Do not use manual tools (e.g., pipe wrenches) in combination with rotation of the drill stem. Manual tools are not designed for the load, and may break.

- The use of such tools creates a significant impact hazard for those in the work area, because they rotate with the drill stem. Manual tool use in combination with a rotating drill stem to attach or break rods is therefore prohibited.
- Manual tools may be used if the drill stem is isolated / positively disengaged.
- Mechanical means of rod separation that are permitted include:
 - Opposing hydraulic controls.
 - Rod locking devices or machine's power vice.
 - Hydraulic breakout tools.
 - Hydraulic foot clamps.

- 4.16.2 Rod box changes present severe crushing hazards. Operators shall ensure all crew members are clear of the machine and hoisting equipment while they are changing rod boxes.

4.17 Rotary, Sonic and Core Drilling

- 4.17.1 In addition to the health and safety procedures identified above, the following general health and safety procedures should be followed when supervising borings with rotary, sonic and core drilling:
- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
 - If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
 - When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use hands to clean drilling fluids from drill rods.
 - When drill rods are rotating, stay clear of the rotating components of the drill rig. Never reach behind or around a rotating drill rod for any reason.
 - Use a long-handled shovel to move cuttings away from the top of the borehole. Never use hands or feet to move cuttings away from the borehole.
 - If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
 - Keep away from area where drill rods are being moved or raised to the rig. Do not stand in the area where a drill rod will fall or slide if it should be dropped.
 - Loud noises may occur during drilling. Hearing protection shall be worn.

4.18 Direct-push

- 4.18.1 The following general health and safety procedures should be followed when supervising drilling borings with direct-push drilling:
- Loud noise may occur during direct-push drilling. Appropriate hearing protection shall be worn.
 - When drill rods are hoisted from the hole, they should be cleaned for safe handling with a suitable rod wiper. Do not use hands to clean drilling fluids from drill rods.
 - If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
 - Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

4.19 Horizontal Directional Drilling

- 4.19.1 During surface to surface operations a 16.4' (5 meters) safe zone shall be established and identified at both the entry and exit locations; no personnel are permitted to be within this zone unless the drill is locked out and the operator is out of the seat.
- 4.19.2 Machine shall be locked out before entering an excavation, changing tools, adding or removing drill stem or doing any other work on tools or the drill stem at the exit end of the bore.
- 4.19.3 A tracking head shall be installed on the drill stem:
- 4.19.4 Assemble drill head using components appropriate to the soil conditions to be encountered (e.g. nozzle, bit, beacon housing, etc.).
- 4.19.5 Ensure all personnel are clear of the bore entry point (outside of identified work zone).

- 4.19.6 At all times two way communication will be maintained at entrance and exit points using two way radios or equally effective communication means. If at any time communication is lost, all work will be stopped until communication is re-established
- 4.19.7 Locate drill head with tracking device at least every half-length of pipe. Adjust direction as necessary to follow the intended bore path.
- 4.19.8 Any drilling fluid returning to the surface shall be cleaned up promptly.
- 4.19.9 Drill pipe should exit the bore at an angle of 5 to 10° from the ground surface.
- 4.19.10 Turn off fluid flow as soon as drill head emerges.
- 4.19.11 Lockout machine and remove drill head using appropriate breakout tools.
- 4.19.12 Select and attach a reamer that allows the return of drilling fluids and cuttings, to reduce frictional pullback forces, and to allow for bend radius of the pipe. Reamer shall be:
 - The smaller of 1.5 times the outside diameter (O.D.) or 12 inches (300mm) larger than the diameter of the product pipe.
 - A diameter less than 1.5 times the diameter of the product may be necessary in collapsing soil formations.
 - Reamed diameter may need to be increased by up to 25% if substantial swelling of the soil is expected to occur.
- 4.19.13 All personnel shall clear the trench or the designated surface zone (16.4 feet [5 meters]) once the reamer is attached. Operator shall only reverse lockout and commence pullback when communication is received from personnel on exit hole side and operator has confirmed the message.
- 4.19.14 Personnel on exit hole side shall ensure reamer is pulled the entire way back to the exit hole.
 - If rotation is started when drill rod and reamer are away from the exit hole, very fast sideways movement of the rod and reamer can occur.
 - Larger reamers and longer lengths of exposed drill rod increase the speed and distance of this movement.
- 4.19.15 If working with trailing drill stem, swivels shall be verified as lubricated and rotating freely by hand prior to use:
 - A freely moving swivel prevents trailing drill stem or product from rotating / whipping.
 - If the swivel does not move freely by hand it shall be removed from service and repaired or replaced.
 - Only use swivels with limited articulation to prevent whipping or cranking action between the reamer and trailing drill pipe or product.
- 4.19.16 It is important to clean and lubricate the tool and drill stem joint threads before each use.
- 4.19.17 Any individual drill pipes that are bent or damaged shall be immediately taken out of service.
- 4.19.18 Occasionally change the order of the lead drill pipe (i.e. move the lead pipe to the end of the stem, or other pipe rotation procedures) to extend drill stem life.
- 4.19.19 Operator should avoid stalling the pipe rotation to avoid stress damage from shock loading.
- 4.20 Drilling at Potential MEC / UXO Sites
 - 4.20.1 If the project site is suspected of containing munitions and explosives of concern (MEC) or unexploded ordnance (UXO), the UXO team will conduct a reconnaissance and MEC / UXO avoidance to provide clear access routes to each site before drilling crews enter the area. The following procedures will be implemented:

- Drilling operations on an MEC / UXO site will not be conducted until a complete plan for the site is prepared and approved by the AECOM UXO Safety Officer. MEC / UXO avoidance shall be conducted during drilling operations on known or suspect MEC / UXO sites.
- The UXO team will identify and distinctly mark the boundaries of a clear approach path for the drilling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No personnel will be allowed outside any marked boundary.
- If MEC / UXO is encountered on the ground surface, the UXO team will clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.
- The UXO team will conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of MEC / UXO that may be in the subsurface. If a magnetic anomaly is encountered, it will be assumed to be MEC / UXO, and the approach path will be diverted around the anomaly. UXO personnel only will operate the appropriate geophysical instrument and identify MEC / UXO.
- An incremental geophysical survey of the drill-hole location(s) will be initially accomplished by the UXO team using a hand auger to install a pilot hole. If MEC / UXO is encountered or an anomaly cannot be positively identified as inert material, Hazardous, Toxic, and Radioactive Waste (HTRW) sampling personnel will select a new drill-hole location.
- Once the surface of a drilling site has been cleared and a pilot hole established as described above, the drilling contractor will be notified that the site is available for subsurface drilling.

4.21 Movement and Transport of Drilling, Boring or Direct-Push Equipment

- 4.21.1 Personnel transporting equipment shall be properly licensed and shall operate the vehicle according to Federal / State / Provincial / Territorial, and local regulations. Refer to *S3AM-005-PR1 Driving* and *S3AM-320-PR1 Commercial Motor Vehicles*.
- 4.21.2 Confirm the traveling height (overhead clearance), width, length and weight of the equipment with the carrier. Identify highway and bridge load, width and overhead limits, to confirm these limits are not exceeded and with adequate margin.
- 4.21.3 Allow for overhang of any drilling, boring or direct-push equipment when cornering or approaching other vehicles or structures.
- 4.21.4 Be aware that the canopies of service stations and motels are often too low for equipment loaded on a trailer to clear
- 4.21.5 Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.
- 4.21.6 Never travel on a street, road, or highway with any part of the drilling, boring or direct-push equipment in a raised or partially raised position.
- 4.21.7 Remove all ignition keys if rig is left unattended unless client requirements specify that the keys remain in the ignition switch at all times.
- 4.21.8 Before moving a rig on location, the operator shall do the following:
 - To the extent practical, walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles.
 - Check the brakes of the truck / carrier, especially if the terrain along the route of travel is rough or sloped.
 - Discharge all passengers before moving on rough or steep terrain.
- 4.21.9 Engage the front axle (on 4x4, 6x6, etc., vehicles) before traversing rough or steep terrain
- 4.21.10 Driving drill rigs along the sides of hills or embankments should be avoided; however, if side-hill travel becomes necessary, the operator shall conservatively evaluate the ability of the rig to remain upright while on the hill or embankment. The possibility shall be considered that the presence of

drilling tools on the rig may reduce the ability of the rig to remain upright (raises the center of mass of the rig).

- 4.21.11 Logs, ditches, road curbs, and other long and horizontal obstacles should be approached and driven over squarely, not at an angle.
- 4.21.12 When close lateral or overhead clearance is encountered, or when backing up, the driver of the rig shall be guided by another person on the ground.
- 4.21.13 Loads on the drill rig and truck shall be properly stored while the truck is moving, and the mast shall be in the fully lowered position.
- 4.22 Loading and Unloading
 - 4.22.1 Consult applicable manufacturer's recommendations for loading and unloading of the equipment.
 - 4.22.2 Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.
 - 4.22.3 Load and unload on level ground.
 - 4.22.4 Use the assistance of someone on the ground as a guide.
 - 4.22.5 Check the brakes on the rig carrier before approaching loading ramps.
 - 4.22.6 Distribute the weight of the rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the height of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
 - 4.22.7 The rig and tools should be secured to the hauling vehicle with ties, chains, and / or load binders of adequate capacity.

5.0 Records

- 5.1 All employee training files shall be maintained in accordance with *S3AM-003PR1 SH&E Training*.
- 5.2 Completed inspections and maintenance inventories shall be maintained the site or project files.

6.0 Attachments

- 6.1 [S3AM-321-ATT1 Core Drilling Machine](#)
- 6.2 [S3AM-321-ATT2 Pre-Drilling, Boring, & Direct-Push Probing Flow Chart](#)
- 6.3 [S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection](#)
- 6.4 [S3AM-321-FM2 Drilling, Boring & Direct-Push Equipment Maintenance Inventory](#)

Americas

Daily Drilling, Boring & Direct-Push Equipment Inspection

S3NA-321-FM1

Site / Project Name _____ Rig Inspector (Name/Company) _____

RIG INFORMATION:

Rig Type	Rotary/Auger Drilling Rig <input type="checkbox"/>	Direct Push Type (DPT) <input type="checkbox"/>
Owner	_____	VIN# _____
Year/Make	_____	Mileage _____
Model	_____	Drill Hrs _____

INSTRUCTIONS: Each shift shall inspect all applicable items. If an unsatisfactory condition (fail) is observed, suspend operation of the equipment and report the condition to the site supervisor immediately.

Emergency Equipment / Devices / Switches	
Kill switches are located and accessible to workers on both sides of the rotating stem. NOTE: Location and number of switches depend on the rig manufacturer; please refer to owner's manual (DPT typically has one switch on control panel).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Kill switches installed by the manufacturer, alarms and other devices (e.g. positive air shut-off valve) tested and in operable condition. All workers familiar with location and operation of devices. NEVER BYPASS, DISABLE, OR REMOVE KILL DEVICES.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
First aid kit adequate and on equipment / readily available.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Absorbent materials on equipment / readily available (spill response).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lb).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Protective Guards	
Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Cables	
Cables on drill rig free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Cables are terminated at the working end with a proper eye splice; either swaged, coupled, or using cable clamps.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Wire ropes are not allowed to bend around sharp edges without cushion material.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Pulleys and Cable Winches	
Pulleys are not bent, cracked, or broken.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Pulleys operate smoothly and freely, without resistance.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Motor is mounted in correct location and tightly secured to drill rig.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Winch capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Safety Latches	
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Flights / Augers / Reamers	
Flights / Augers / Reamers are not bent, cracked, or broken. NOTE: Flights / Augers / Reamers failing inspection must be removed from jobsite.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A

Flights are blunt to prevent the risks of cuts.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Auger keys are not bent, cracked/fractured, excessively worn, or otherwise damaged.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Auger bolt holes and threads are not damaged.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Inspect flights/augers for metal burns. NOTE: Burrs must be filed to flat surface.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Augers / Reamers lying flat on the ground (avoid stacking).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Augers / Reamers over 50lbs (22.7kg) moved mechanically. (Avoid manual lifting).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Drill String	
Appropriate break out tool(s) available.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Rod box and power vice operating smoothly and freely.	
Drill string are not bent and do not have any cracks/fractures.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Drill string connections (e.g. pins, threads, couplers) are of the proper type, are not bent, have no cracks/fractures, and are not excessively worn.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Swivel connectors (for trailing horizontal drill stem) lubricated and freely rotating.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Mast	
Mast is free of bends, cracks, or broken sections.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
All mounting hardware (pins, bolts, etc) in place.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
No moving of drill rig or maintenance/repairs while mast is in vertical position.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Hammering Device	
Hammer free of cracks, fatigue, or other signs of excessive wear.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Hammer connections are secure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Leveling Devices	
Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulics leaks.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Outriggers are properly supported on the ground surface to prevent setting into the soil (use of outrigger support pads).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Controls	
Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Controls are not blocked or locked into an operating position.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Installed lights, signals, gauges, and alarms operate properly.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Lifting Devices	
Slings, chokers, and lifting devices (straps, not chains) inspected before using and are in proper working order. NOTE: Damaged units are labeled and removed from jobsite.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Shackles/Clevises are in proper working order with pins/screws in place that is to be used while lifting.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Hydraulic System	
Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. NOTE: Check while pressurized.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Hydraulic oil reservoir has appropriate amount of oil and not leaking.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Pump Lines (water, grout, etc)	
Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A

Ladders	
Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Ladders and platforms not to be used for tool storage- keep ladders and operator platforms clear during drilling.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Tires / Tracks	
Tires / Tracks on rig are not excessively worn and free of any debris or foreign material.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
General	
General condition – exterior (no structural damage, no loose bolts, platform tidy, etc.)	
General condition – interior (cab clean, tidy)	
Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Rig is of appropriate size to meet job requirements.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Maintenance log available for previous 3 months to confirm proper maintenance/inspection.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Exhaust	
Exhaust system is free from defect and routes engine exhaust away from drill rig workers.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Fuels	
Fuel stored in an approved and properly labeled container.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Fuel transfer lines free from signs of excessive wear and not leaking.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Exclusion/Work Zones	
The exclusion/work zone is centered over the borehole (and if applicable, bore exit point) and the radius equal to or greater than the height of the mast (measured from ground level).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
The exclusion/work zone is clear of tripping hazards.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
The exclusion/work zone communicated to concurrent/adjacent operations to prevent overlap of work zones or line of fire.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Subsurface Utilities / Installations and Overhead Obstructions	
Subsurface utilities / installations have been confirmed as identified and cleared through site observation and review of the completed <i>S3NA-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist</i> .	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the Minimum Approach Distance (MAD).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Rig Repairs	
Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
Specialized PPE	
When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict falls to less than six feet (1.83 meters).	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A
When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input type="checkbox"/> N/A

Comments:

Signature of Inspector: _____

Date: _____

Americas

Drilling, Boring & Direct-Push Equipment Maintenance Inventory

S3NA-321-FM2

EQUIPMENT (MAKE, MODEL, SERIAL #)	EQUIPMENT OWNER	EQUIPMENT STATUS (<i>On Hire,</i> <i>ACTIVE,</i> <i>DECOMMISSIONED</i>)	FREQUENCY OF SERVICE	SERVICE TYPE	MANUFACTURER'S STANDARDS	INDUSTRY STANDARDS	LEGISLATED REQUIREMENTS	LOCATION OF EQUIPMENT

Americas

Core Drilling Machine

S3AM-321-ATT1

1.0 Objective / Overview

- 1.1 Core drilling machines are used on all types of jobs. They can be electrical or gas powered and come with a stand or can be hand held. Caution should be used when operating such a machine. It may look harmless and easy to run, but drilling machines have many hazards.
- 1.2 Prior to coring activities the location should be checked for buried utilities in accordance with S3AM-331-PR1 *Underground Utilities*.

2.0 Safe Operating Guidelines

- 2.1 Clean the flanges before mounting the blade.
- 2.2 Make sure the blade is correct for the material being cut and that the arrow on the blade corresponds with the direction of rotation of the machine spindle.
- 2.3 Use built-in vacuum or bolt-down anchors depending on the type of surface to be cored. Do not bypass anchoring system.
- 2.4 Properly manage power cable for electric units to prevent slips, trips or falls by the operator or those nearby.
- 2.5 Avoid tilting the blade when cutting.
- 2.6 Use only the machines that have an approved safety guard.
- 2.7 Remove the diamond blade from the machine during transit to prevent accidental damage.
- 2.8 Inspect the blades frequently to detect cracks or undercutting of the steel center.
- 2.9 Do not let excessive heat be generated at the cutting edge of the blade.
- 2.10 Use adequate water supply to both sides of the blade.
- 2.11 Follow the manufacturers recommended pulley sizes and operating speeds for specific blade diameters.
- 2.12 Make sure to tighten drive belts to ensure full available power.
- 2.13 Don't force the blade on the blade shaft or mount blade on an undersized spindle.

3.0 Potential Hazards

- 3.1 Utilities
- 3.2 Electricity
- 3.3 Flying debris
- 3.4 Noise exposure
- 3.5 Inadequate housekeeping
- 3.6 Fumes or dust
- 3.7 Pinch points
- 3.8 Binding/biting – torque control

**4.0 Training Requirements**

- 4.1 Review of applicable SOPs (e.g., S3AM-305-PR1 *Hand & Power Tools*; S3AM-302-PR1 *Electrical Safety*).

- 4.2 Demonstrated knowledge on the use of a coring machine.
- 4.3 Review and follow manufacturers' operating guidelines.

5.0 Personal Protective Equipment (Level D PPE)

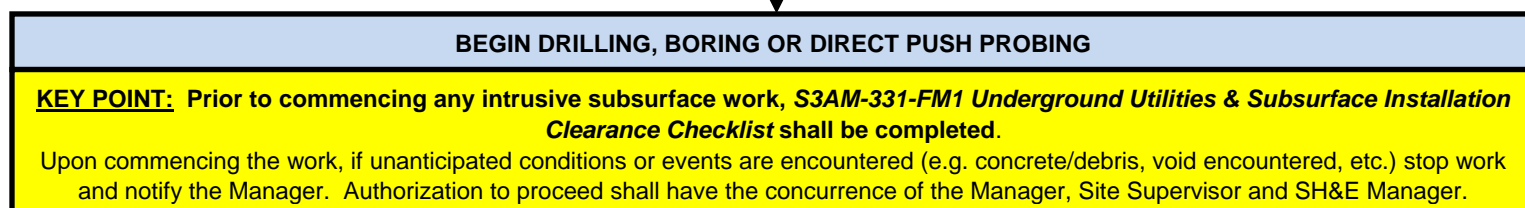
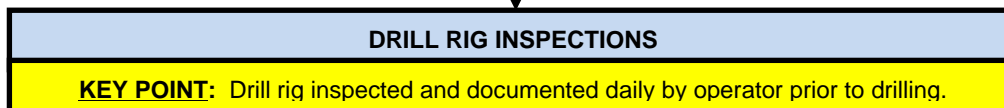
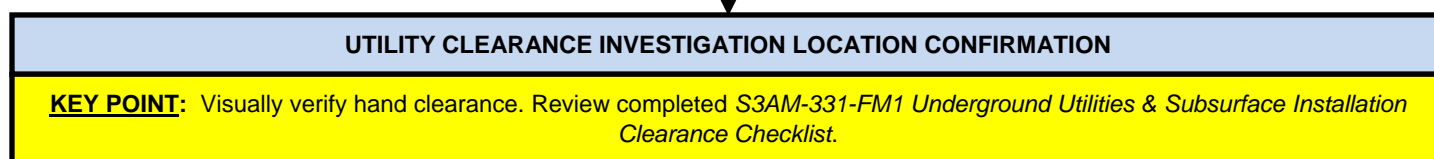
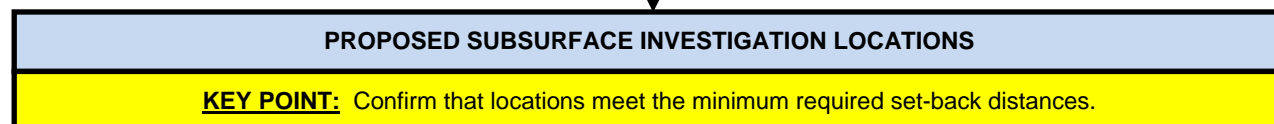
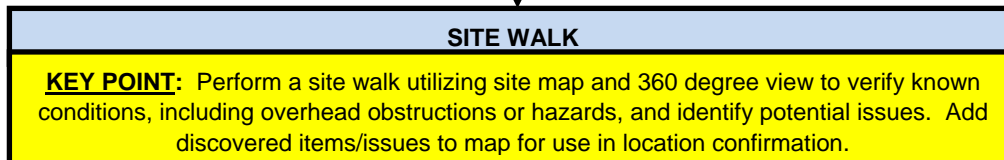
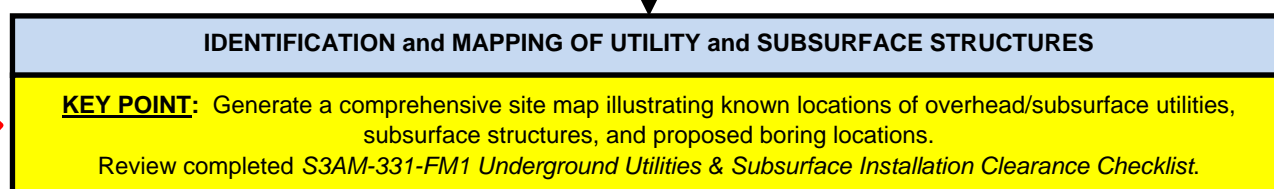
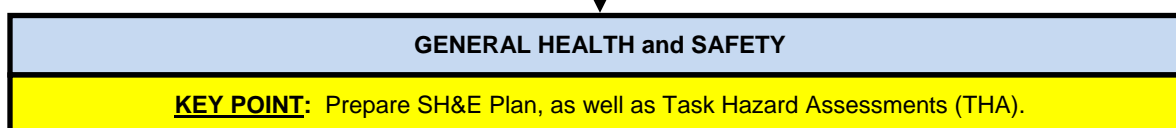
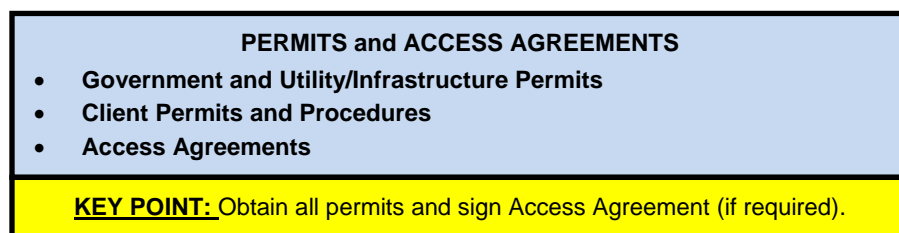
- 5.1 Hard hat
- 5.2 Safety Vest
- 5.3 Leather gloves
- 5.4 Face shield
- 5.5 Steel-toed/composite-toed boots
- 5.6 Hearing protection
- 5.7 Respirator or dust mask (as applicable to the respiratory hazards)

6.0 Other Safety Tips

- 6.1 Keep fingers and hands away from the cutting edge.
- 6.2 Hold handle firmly when operating.
- 6.3 A subsurface utility clearance shall be performed prior to initiating drilling operations.
- 6.4 Stand firmly and apply body weight at anchored side of guarded platform.

Pre-Drilling, Boring & Direct Push Probing Flow Chart

S3AM-321-ATT2

Before Any Drilling, Boring and Direct Push Probing Activities

Overhead Lines & Obstructions

S3AM-322-PR1

1.0 Purpose and Scope

- 1.1 Provides the safe work requirements to be observed where overhead obstructions (e.g., cable trays, pipe racks, etc.), overhead utilities, or other lines are present at a work location, including, but not limited to electric power lines, electrical apparatus, or any energized (exposed or insulated) parts, communication wires, or any other overhead wire or cable.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Arc Flash Hazard** – A dangerous condition associated with the possible release of energy caused by and electric arc. Arc flash is the light and heat produced from an electric arc supplied with sufficient electrical energy to cause substantial damage, harm, fire, or injury.
- 2.2 **Electrical Hazard** – A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.
- 2.3 **Minimum Approach Distance (MAD)** – The MAD is the closest distance any employee or any part of the operating equipment is permitted to approach an energized or a grounded object.
- 2.4 **Qualified Person (Electrical Transmission and Distribution)** – A person trained and knowledgeable in the construction and operation of electrical transmission and distribution equipment or a specific work method, and has been trained to recognize and avoid electrical hazards that might be present with respect to that equipment or work method.
- 2.5 **Types of Overhead Lines / Obstructions (examples):**
 - Overhead electric power lines
 - Structural cable supports
 - Guy wires
 - Cable television / communication lines
 - Cable Trays
 - Pipe Racks
 - Low Clearance Overpasses

3.0 References

- 3.1 S3AM-004 PR1 Incident Reporting, Notifications & Investigation
- 3.2 S3AM-010-PR1 Emergency Response Planning
- 3.3 S3AM-209-PR1 Risk Assessment & Management
- 3.4 S3AM-302-PR1 Electrical Safety
- 3.5 S3AM-303-PR1 Excavation

4.0 Procedure

- 4.1 Roles & Responsibilities

4.1.1 **Manager**

- Identify conditions where overhead electric power lines and other overhead obstructions may be present and outline what is required in the SH&E Plan and Task Hazard Assessments. Refer to the *S3AM-209-PR1 Risk Assessment & Management*.
- Confirm electrical and communication lines, and as appropriate other overhead obstructions, are identified on all site and project drawings.
- Coordinate and communicate with overhead electrical line owner or operator to identify and implement appropriate control measures.
 - Provide adequate advance notification to the Overhead Electrical Line Owner / Operator to allow for insulation or isolation and grounding of the line(s) if required.
 - Confirm the Overhead Electrical Line Owner / Operator(s) are fully informed as to when the operations are to begin, end and when any location changes are planned if applicable.
- Confirm Employees are trained as required for the scope of work and associated hazards.
- Coordinate and communicate with subcontractors or employees working around overhead electric power lines and as applicable, other overhead obstructions.
- Confirm the *S3AM-322-FM1 Overhead Electric power lines Acknowledgement* is completed by concurrent operations working around overhead electric power lines on the worksite.

4.1.2 **Safety Health & Environment (SH&E) Manager**

- Assist and support the Manager in planning and responding to concerns regarding the exposure to overhead electric power lines.

4.1.3 **Employees**

- Maintain current training required for the scope of work and associated hazards.
- Inform the Manager of location conditions that may expose risks to overhead electric power lines.
- Comply with established minimum approach distances.

4.2 **Training**

4.2.1 The Manager shall confirm all Employees are oriented to the SH&E Plan and Task Hazard Assessment (THA) process, in accordance with *S3AM-209-PR1 Risk Assessment & Management*.

4.2.2 Confirm training requirements were met prior to work starting.

-
- Employee orientation shall include the Location Specific Emergency Response Plan.
- Proof of training and orientation shall be documented and retained in the project files.

4.2.3 Managers shall confirm that each Employee has received training required for the scope of work and associated hazards in accordance with *S3AM-003-PR1 SH&E Training*.

4.2.4 Additional training requirements may include, but are not limited to:

- The limitations of an insulating link / device, proximity alarm, and range control (and similar) device, if used.
- Grounding and bonding procedures.
- Client specific requirements

4.3 General Requirements

- 4.3.1 The AECOM Manager or supervisor and employees shall perform a walk-thru of the work site and / or review of the work area / travel route to identify the overhead electric power lines and any other overhead obstructions that could be impacted by the work. Consider high profile equipment, equipment in transport, swing radius of equipment, potential for shifting loads, etc. AECOM personnel may be accompanied by other applicable personnel (e.g. client representatives, contractors operating concurrently, etc.).
- 4.3.2 The location or project specific SH&E Plan shall identify all overhead line hazards and provide suitable methods of elimination or control. All involved or affected workers shall review the SH&E Plan to confirm proper communication of the overhead line hazards and awareness of the control measures associated with their work.
- 4.3.3 Assess applicable factors such as, but not limited to:
- Scope of work (e.g. hoisting materials, excavation, grubbing, etc.).
 - Transportation route.
 - Hoisting, excavating, or other equipment to be operated.
 - Height, placement, and reach of equipment.
 - Equipment or material loading / unloading.
 - Location(s) of electric power lines, communication lines, guy wires, etc.
 - Worker training and experience.
 - Soil or ground condition and environmental conditions.
 - Interruptions to electrical services.
 - Hazard to public.
 - Use of ladders.
 - Pipe and other conducting materials.
 - Notification of electric utility owner.
 - Changing conditions.
 - Communication of all hazards to all workers including contractors, sub-contractors, and concurrent operations.
- 4.3.4 Task Hazards Assessments (THAs) shall be completed to record the hazards and control measures specific to the task, including those related to overhead line and obstructions hazards, prior to undertaking assigned tasks. THAs shall be reviewed and signed by all workers involved in the specific task.
- 4.3.5 Should adverse weather conditions cause the work associated with overhead lines to be unsafe, the activities shall be discontinued.
- 4.3.6 Managers or designated employees shall formally notify all concurrent operations, or any others who may not have had reason to review and sign the related SH&E Plan or THAs, of work that is to be done in the vicinity of overhead lines at distances less than 50 feet (15.25 meters), and for non-electrical obstructions, at distances less than 10 feet (3.05 meters) if appropriate to the obstruction's potential hazards, and obtain the operator's assistance in protecting workers involved.
- Formal notification may be accomplished through a review of the SH&E Plan or THAs by the concurrent operator and associated personnel, as evidenced by signing the respective document's acknowledgement.

- Alternately, the concurrent operations may acknowledge having reviewed AECOM's procedures with a separate acknowledgment form. *S3AM-322-FM1 Overhead Electric Power Lines Acknowledgement Form* or equivalent may be used.
 - Prior to equipment operation within 10 feet (3.05 meters) of non-electrical obstructions, as appropriate to potential hazards associated with the obstruction, the Owner/Operator should be contacted to obtain specific details regarding the obstruction such as piping or tray contents,
- 4.3.7 Overhead lines are presumed to be energized unless the Overhead Electrical Line Owner / Operator confirms that the overhead line has been, and continues to be de-energized and visibly grounded at the worksite.
- 4.3.8 Overhead lines are presumed to be uninsulated unless the Overhead Electrical Line Owner / Operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution confirms that a line is insulated.
- 4.3.9 Confirm accurate measurement of load heights, maximum equipment radius and height or reach of any other equipment that could potentially encroach on the safe limit of approach for the overhead electrical line, guy wires, or other applicable overhead obstructions.
- The height of all applicable overhead lines and obstructions that pose contact or encroachment potential shall be determined prior to work commencing.
 - The height of electric power lines may only be determined by the client, utility company professional, or by using an approved electronic measuring device.
 - Awareness shall be maintained for any elements that could affect clearance (e.g. snow pack, ice or snow weighing down lines, excessive heat causing sag, etc.).
 - Caution shall be exercised when working or travelling near overhead lines having long spans, since they tend to be more prone to lateral swing in response to the wind and can present a contact hazard.
 - All low hanging communication lines in close proximity to energized lines shall be clearly identified as *Encroaching on Energized Lines*.
- 4.3.10 Managers shall contact the overhead owner/operator (i.e. local utility company) if work is to be done or before equipment is operated within 50 feet (15.25 meters) of an energized overhead line, to determine the voltage of the overhead line and establish the appropriate MAD.
- All inquiries regarding electric utilities shall be made in writing and a written confirmation of the outage / isolation shall be received by the appropriate AECOM Manager prior to the start of the task that may impact the utility.
- 4.3.11 Until the voltage of the overhead electrical line is known and the MAD established, an exclusion zone shall be created at ground level beneath and 50 feet (15 meters) perpendicular to the overhead electric power lines on each side.
- The exclusion zone shall be demarcated with visual indicators (e.g., signage, flagging, paint, cones). No equipment shall enter the exclusion zone without approval from AECOM management.
 - Unqualified employees shall maintain a safe clearance distance in accordance with the established MAD when working in an elevated position near energized overhead lines. For additional information associated with Qualified Employees refer to *S3AM-302-PR1 Electrical Safety*.

- 4.3.12 The Minimum Approach Distance (MAD) as it relates to Voltage varies from jurisdiction to jurisdiction. The MAD or the regulatory minimum distance requirements, whichever is more stringent, shall be maintained. The below chart shows the Phase-to-Phase voltage rating voltages in kilovolts and the MADs applicable to all AECOM operations:

Minimum Approach Distances (MAD)

Voltage Range (Kilovolts) (Phase-to-Phase)	Minimum Approach Distance (MAD) in Feet (Meters)
Personnel shall allow for equipment movement and electrical line swaying when establishing a M.A.D.	
0 – 50 KV	10 (3)
Over 50 – 200 KV	15 (5)
Over 200 – 350 KV	20 (6)
Over 350 – 500 KV	25 (8)
Over 500 – 750 KV	35 (11)
Over 750 – 1,000 KV	45 (14)
Note: This requirement shall apply except where client, local, or governmental regulations are more stringent.	

Source: American National Standards Institute, Publication B30.5.

- 4.3.13 An appropriate distance shall be kept between equipment, its occupants, their tools and energized overhead lines, electrical apparatus, or any energized parts.
- 4.3.14 These minimum approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 13.5 feet (4.15 meters).
- If the travelling equipment, including load, is over 4.15m (13.62ft) a transportation permit shall be acquired from the appropriate jurisdiction to travel on any public road or highway.
 - Consult local jurisdiction as some US states may use heights of up to 4.45m (14.6ft).
 - Notification of appropriate utility companies may be required in conjunction with the transportation permit. Jurisdictional requirements shall be verified prior to transport.
 - Route shall be checked for clearance of overhead electrical and communication lines prior to transport.
 - A designated signaler will be utilized when the height of the equipment, buildings, tractor / trailers or any other transport equipment travelling under an overhead electrical line is greater than 4.15m (13.62ft).
- 4.3.15 Employees shall not place earth or other material under or beside an electrical overhead line if doing so reduces the safe clearance to less than 50 feet (15.25 meters) or, if appropriate to potential hazards associated with other types of overhead obstruction, less than 10 feet (3.05 meters). To maintain a safe distance:
- Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).
 - Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.
 - Position signs or other devices to determine the “Danger Zone”.
 - Inform all job site personnel of the danger zone and the safe distances required.
 - Beware of atmospheric conditions, such as temperature, humidity, and wind that may dictate more stringent safety procedures.

- 4.3.16 If employees are to climb or perform work on poles or towers, the structures shall be confirmed as capable of withstanding the weight and activity without failure.
- 4.3.17 If holes are dug for poles or foundations for structures, appropriate measures shall be taken to prevent inadvertent entry by personnel or equipment. Refer to *S3AM-303-PR1 Excavation*.
- 4.3.18 Operation of heavy equipment and cranes in areas with overhead lines represents a significant arc flash and electrical hazard to all personnel on the job site.
 - Accidental contact with an energized overhead line or arcing between a high power line and grounded equipment, can cause harm to nearby equipment operators or ground personnel and damage to power transmission systems and / or operating equipment.
 - Equipment will be repositioned and blocked so that no part, including cables, can come within the established minimum clearances.
- 4.3.19 Gravel trucks, cranes, boom trucks, etc. shall retract, stow and lower boxes, outriggers, booms, etc. to the travel position prior to entering municipal and client owned roads (e.g. leaving plant sites, work over rig sites, battery sites, and storage yards) and any time travel may put the equipment within the MAD of an electrical line.
- 4.3.20 When a signal person is required, the individual shall wear reflective striping (coveralls or vest) and carry an air horn or other appropriate means of emergency communication.
- 4.3.21 The signal person shall be aware of the potential electrical line hazards, be verified as competent by their supervisor and not have any other duties while acting as the signal person.
- 4.3.22 The signal person shall remain outside the MAD and in a position that allows for monitoring of equipment or loads to prevent encroachment on the MAD.
- 4.3.23 Signs, pylons, high visibility tape and / or signalers shall not be removed until the last piece of AECOM equipment has traveled under the overhead electrical line.
- 4.4 Minimum Approach Distance (MAD) Reduction
 - 4.4.1 Where any work task will not allow the MAD to be maintained, an alternate means of protection shall be implemented by the Manager and approved by the SH&E Manager. In order of preference, acceptable procedures are:
 - De-energize the overhead line(s) / lockout by local utility authorities; or
 - Implement alternative procedures as identified by the Overhead Electrical Line Owner / Operator or a registered professional engineer.
 - 4.4.2 De-energize Overhead Lines
 - Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site overhead lines are often under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the Overhead Electrical Line Owner / Operator. De-energizing of an overhead line often requires advance coordination with the Overhead Electrical Line Owner / Operator. At least one week advance notice should be provided.
 - Managers shall confirm with the utility Overhead Electrical Line Owner / Operator that the overhead line has been de-energized and visibly grounded at the job site.
 - 4.4.3 Alternative Procedures
 - Managers may implement alternative procedures to prevent arc flash and electrical contact. These procedures shall be identified by the Overhead Electrical Line Owner / Operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution.

- A planning meeting with the Manager, SH&E Manager and the Overhead Electrical Line Owner / Operator (or registered Professional Engineer) shall be held to determine the most effective alternative procedures.
- Alternative procedures shall meet all client, local and governmental regulatory requirements.
- The work will be conducted by qualified and competent individuals, following the alternative written safe work procedures. All others are restricted from entering the MAD.
- Insulating Barriers shall be rated for the voltage line being guarded. These barriers may not be part of or attached to the equipment. The MAD shall only be reduced within the designed working dimensions of the insulating barrier. This determination shall be made by a Qualified Person in accordance with local or governmental requirements for work practices near energized equipment.
- Consult *S3AM-302-PR1 Electrical Safety* procedures to properly ground equipment and for limitations of grounding.
- Dedicated Line Spotters shall be trained to enable them to effectively perform their task, including training on the applicable local and governmental regulations.
- No work that encroaches on an energized power line will be completed outside of daylight hours.

4.5 Additional Safety Measures.

- 4.5.1 When equipment shall repeatedly travel beneath electric power lines, a route shall be plainly marked and “rider poles” of non-conductive material shall be erected on each side to confirm equipment structures are lowered into a safe position.
- 20" X 28" (50.8cm X 71.12cm) Danger Overhead Power Lines signs, which are highly visible, shall be erected at a height of 1.8 meters (6ft) on each side of the electrical line. A combination of pylons and high visibility tape shall be placed underneath the electrical line.
 - These signs shall be in plain view of equipment traveling in either direction, but no closer than the MAD.
 - If physical guards (i.e. goal posts, rider poles) are used, the guards shall be of non-conductive material and consist of a pole on each side of the approach connected by a rope.
 - The poles will be placed at the MAD from and on each side of the electrical line. The ropes will be set at a height, which will maintain the MAD from the electrical line.
- 4.5.2 Watch for uneven ground that may cause vehicles and equipment to weave, bob, or bounce.
- 4.5.3 The following additional safety measures shall be implemented as needed when working around energized power lines:
- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
 - Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
 - Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.
 - Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures outlined in this document.

4.6 Emergency Planning

4.6.1 Managers shall complete a location specific emergency response plan as part of their location or project specific SH&E Plan for all operations during which equipment is operated within 50 feet (15.25 meters) of an energized overhead electrical line or conductor. Refer to *S3AM-010-PR1 Emergency Response Planning*. This plan shall identify the following information:

- The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
- The safest means of evacuating from equipment that may be energized.
- The potentially energized zone around the equipment.
- The need for crew in the area to avoid approaching or touching the equipment and the load.
- The means to de-energize the electrical line or live conductor.
- The contact information for the utility Overhead Electrical Line Owner / Operator and emergency services.

4.6.2 In the event of an incident, the Employee shall report it in accordance with *S3AM-004 PR1 Incident Reporting, Notifications & Investigation*.

4.6.3 All damaged utilities shall be repaired by a qualified and / or licensed professional.

5.0 Records

5.1 Retain the Overhead Electric power lines Acknowledgement forms and any document related to requests of and confirmation from the Overhead Electrical Line Owner / Operator in the project files. Documentation of employee training completed shall be retained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

6.1 [S3AM-322-FM1 Overhead Electric Power Lines Acknowledgement Form](#)

Americas

Overhead Electrical Lines Acknowledgment

S3NA-322-FM1

Company information		
Name of Employer or Contracting Operation:		
Address:		
City:	Province:	Postal Code:
Telephone:	Fax:	
Project / Location Name:		
AECOM Contact Name:		
Acknowledgement		
<p>I acknowledge that I have received a copy of <i>S3NA-322-PR1 Overhead Lines</i> and any other AECOM documentation related to the overhead electrical lines.</p> <p>List any additional documentation received:</p> <p>I understand that this worksite may have Overhead Electrical Hazards, and I have discussed the received documentation with all of our company staff who will be on this site.</p>		
Name & Title (Print)	Signature	Date

Powered Industrial Trucks

S3AM-324-PR1

1.0 Purpose and Scope

- 1.1 Provides the requirements for the safe operation and maintenance of powered industrial trucks.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.
- 1.3 This procedure does not apply to aerial lifts, cranes, or vehicles intended primarily for earth-moving or over-the-road hauling

2.0 Terms and Definitions

- 2.1 **Powered Industrial Truck** - a mobile, power-propelled truck used to carry, push, pull, lift, stack, or tier materials. Forklifts, pallet trucks, rider trucks, fork trucks, lift trucks, pallet jacks, motorized hand trucks, and skid steer loaders are all types of powered industrial trucks.

3.0 References

- 3.1 S3AM-304-PR1 Fall Protection
- 3.2 S3AM-323-PR1 Aerial Work Platforms

4.0 Procedure

- 4.1 Roles and Responsibilities

4.1.1 Operator

- Complete the *S3AM-324-FM1 Pre-Operation Powered Industrial Truck Checklist* or equivalent, prior to daily use to confirm that truck systems are fully functional (e.g., brakes, lights, horn, operations).
- Report any equipment deficiencies to supervisor. Confirm unsafe equipment is not operated until deficiencies are corrected.
- Complete and maintain applicable Powered Industrial Truck training specific to the type of truck to be operated according to the regulatory requirements prior to operating the equipment.
- Operate powered industrial truck according to manufacturer's operating manual.

4.1.2 Manager or Supervisor

- Strictly enforce all powered industrial truck operation procedures.
- Confirm that all authorized personnel are trained in the operation of the trucks.
- Verify certification for operating a forklift through training and evaluation. Review certification and completed *S3AM-324-FM2 Powered Industrial Truck Skill Evaluation* or equivalent.
- Train all other employees on the applicable pedestrian safety rules.
- Confirm equipment meets the applicable jurisdictional standards and requirements. Remove any defective trucks from service.
- Maintain the truck according to manufacturers' specifications.

4.1.3 Employees (other than operator)

- Wear high visibility apparel when working around powered industrial trucks.
- Yield to powered industrial trucks.
- Stay outside of work area or swing zone of any operating equipment.

- Enter work area or swing zone only if eye contact with the operator has been made and the operator has clearly communicated permission.
- If working from an elevated work platform:
 - Trained to use the platform and regarding fall protection, refer to *S3AM-323-PR1 Aerial Work Platforms* and *S3AM-304-PR1 Fall Protection/Working at Heights*.
 - Wear fall protection devices and be secured within the platform to the manufacturer's anchorage point.

4.1.4 **Safety, Health and Environment (SH&E) Manager**

- Provide technical guidance as to this procedure.
- Verify operators are trained and competent to operate the specific equipment by reviewing training documentation (i.e. certification, ticket, etc.) and ensuring a skill evaluation is conducted using *S3AM-324-FM2 Powered Industrial Truck Skill Evaluation* or equivalent.

4.2 Training

- 4.2.1 Training will be provided by a qualified instructor with the powered industrial truck knowledge, training, and experience to train and evaluate operator competence. Training is equipment specific.
- 4.2.2 All Operators shall successfully complete training according to the regulatory requirements before being allowed to operate a powered industrial truck.
- 4.2.3 Training shall consist of formal instruction and practical application, with documented evaluation of operator competency by the instructor.
- 4.2.4 Training will include the following topics:
 - Operating instructions, warnings, and precautions for the types of powered industrial truck the Operator will be authorized to operate.
 - General and specific legislation.
 - Startup and shutdown procedures.
 - Using a spotter and communication requirements (i.e. hand signals)
 - Differences between the powered industrial truck and an automobile.
 - Powered industrial truck controls and instrumentation, where they are located, what they do, and how they work.
 - Engine or motor operation.
 - Steering and maneuvering with and without a load.
 - Visibility (including restrictions due to loading).
 - Fork and attachment adaptation, operation, and use limitations.
 - Powered industrial truck capacity.
 - Powered industrial truck stability.
 - Powered industrial truck inspection and maintenance.
 - Refueling and/or charging and recharging of batteries.
 - Operating limitations.
 - Any other operating instructions, warnings, or precautions listed in the operator's manual for the types of powered industrial truck that the Operator is being trained to operate.
 - Surface conditions where the powered industrial truck will be operated.
 - Composition of loads to be carried and load stability (e.g. center of gravity, load centers, etc.).
 - Load manipulation, stacking, and unstacking.
 - Pedestrian traffic in areas in which the powered industrial truck will be operated.
 - Potential ground / floor conditions, narrow aisles and other restricted places where the powered industrial truck will be operated.

- Hazardous (classified) locations where the powered industrial truck will be operated.
- Ramps and other sloped surfaces that could affect the powered industrial truck's stability.
- Closed environments and other areas where insufficient ventilation or poor vehicle maintenance could cause a build-up of carbon monoxide or diesel exhaust.
- Other unique or potentially hazardous environmental conditions in the workplace that could affect safe operation.

4.2.5 Operator's performance will be evaluated once every three years or more frequently if required by regulation. Refresher training will be provided in the following circumstances:

- Operator has been observed to operate the powered industrial truck in an unsafe manner.
- Operator has been involved in an incident.
- Operator has received an evaluation that reveals that the powered industrial truck is not being operated safely.
- Operator is assigned to drive a different type of powered industrial truck.
- A condition in the workplace changes in a manner that could affect safe operation of the powered industrial truck.
- As required by jurisdictional regulation.

4.3 Certification

4.3.1 Once training is completed, the appropriate Project Manager / Supervisor will verify the Operator is trained and competent to operate the powered industrial truck by reviewing training documentation (i.e. certification, ticket, etc.) and ensuring the applicable competency assessment / evaluation is conducted. The certification / ticket will include the name of the Operator, the date of the training, the date of the evaluation, and the identity of the person performing the training or evaluation.

4.4 Operations

There are many types of powered industrial trucks for various applications. Use a type suitable for the task. *S3AM-324-ATT1 Powered Industrial Truck Designations* provides additional information on the types of powered industrial trucks available.

4.4.1 The powered industrial truck will be inspected at the beginning of each shift prior to operation using the checklist. Refer to *S3AM-324-FM1 Pre-Operation Powered Industrial Truck Checklist* or equivalent.

4.4.2 Approved powered industrial trucks will carry labels, nameplates, or identifying marks indicating the following:

- Approval of the truck for fire safety purposes by a nationally recognized testing laboratory;
- Capacity of the truck and its attachments;
- Operation and maintenance instructions; and
- Designation of the truck, based on fuel type and fire safety features. The eleven standard truck designations are discussed in *S3AM-324-ATT1 Powered Industrial Truck Designations*.
- Confirm that all labels, nameplates, or identifying marks are maintained in legible condition.

4.4.3 If at any time a powered industrial truck is found to be in need of repair, defective, or in any way unsafe, the truck will be taken out of service until it has been restored to a safe operating condition.

- Report any damage or problems identified during the inspection to your immediate supervisor.
- Tag and remove equipment from service when defects are found that can affect the safe operation.
- Do not use equipment until the damage or problems have been corrected.

- 4.4.4 Review and follow truck operating instructions as provided in the machine's operator manual.
- 4.4.5 Powered industrial trucks will not be driven up to anyone standing in front of a bench or other fixed object to avoid a serious crushing injury.
- 4.4.6 Securely fasten seat belts and/or other restraining devices if the powered industrial truck is so equipped. Remain seated at all times while the truck is in operation.
- 4.4.7 Never engage in stunt driving or horseplay.
- 4.4.8 Use trucks only for the designed purpose. Do not use trucks to bump, push, or otherwise move materials or other trucks.
- 4.4.9 Restrict the use of trucks in areas where large numbers of pedestrians are present (e.g., break areas, primary exits, etc.).
 - Separate truck traffic and ground personnel where possible.
 - If possible, install physical barriers between workstations and truck travel paths.
- 4.4.10 Confirm clear vision of load, path of load and path of travel are unobstructed:
 - If obstructed do not drive or attempt to lift or lower loads with without the assistance of a qualified spotter.
 - If load obstructs forward view and it is safe to do so, operate the powered industrial truck in reverse with the assistance of a qualified spotter.
- 4.4.11 Be attentive to the swing radius of the forks or attachments when turning.
- 4.4.12 Slow down and sound the horn at intersections, cross aisles, building corners and other locations where vision is obstructed. Lightly tap the horn to warn pedestrians when approaching from behind.
- 4.4.13 Use extreme caution on or near ditches, holes, embankments, grades, ramps, or other slopes.
 - Avoid turning on grades.
 - Avoid use of the truck in areas where cracks and crumbling surface materials may be present.
 - Never run over loose objects on the roadway surface.
 - Do not make quick starts, jerky stops, or turns at excessive speeds.
- 4.4.14 Operate a powered industrial truck only at those speeds that will permit it to be stopped safely and do not negatively impact stability of equipment and/or load.
 - Consult manufacturer's recommendations.
 - Pay particular attention to wet or slippery surfaces.
 - Forklifts operated indoors shall not be operated at a speed in excess of 5 miles (8 kilometers) per hour.
- 4.4.15 Observe all traffic regulations and signage. Maintain at least three truck lengths from other vehicles following the same travel path.
- 4.4.16 Cross railroad tracks or other bumps in the travel path diagonally provided doing so does not produce additional hazards.
- 4.4.17 Do not operate the powered industrial truck while carrying loose items, tools or other equipment in the cab.
- 4.4.18 Powered industrial trucks will not be driven up to anyone standing between the operated truck and another piece of equipment, a structure or any other object that could present a crushing hazard.
- 4.4.19 No person will be allowed to stand or pass under the elevated portion of any powered industrial truck, whether loaded or empty.
- 4.4.20 Passengers are not permitted on any part of a powered industrial truck unless the truck has been designed to accommodate a passenger, the appropriate safety restraining device is provided and authorization has been obtained.

- 4.4.21 Keep body parts within the truck while driving. Arms, legs or any other body part will not be placed between the uprights of the mast, outside the running lines of the truck or any other part of the truck where a shear or crushing hazard may exist.
- 4.4.22 In the event that a powered industrial truck overturns, do not attempt to jump from the machine. Stay in the truck, holding on firmly and leaning in the opposite direction of the overturn.
- 4.4.23 When a powered industrial truck is left unattended and before dismounting, load engaging means will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheel chocks will be used if the truck is parked on an incline.
- 4.4.24 A safe distance will be maintained from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Powered industrial trucks will not be used for opening or closing freight doors.
- 4.4.25 There will be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.
- 4.4.26 An overhead guard will be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application, but not to withstand the impact of a falling capacity load.
- 4.4.27 A load backrest extension will be used whenever necessary to minimize the possibility of the load or part of it falling rearward.
- 4.4.28 Powered industrial trucks will not be parked so as to block fire aisles, access to stairways, or fire equipment.
- 4.4.29 If a powered industrial truck is used to lift a personnel platform, other requirements are necessary, including:
 - Employees in a platform will utilize a full-body harness and fall arrest system that is secured to the manufacturer's anchorage point within the platform.
 - The platform will have a full railing system, including toeboards, on all four sides.
 - The lift equipment shall be designed by the manufacturer to lift personnel platforms and will be capable of supporting the weight of the platform, personnel and equipment to be used.
 - The platform shall be certified, approved and compatible to the powered industrial truck to be used and will be designed for positioning personnel.
 - The platform shall be installed according to manufacturer's specifications and secured to the lift equipment in addition to the support provided by the forks or other approved powered industrial truck attachment.
 - Confirm the maximum number of workers permitted to occupy the platform is not exceeded.
 - The personnel platform shall not be occupied while a powered lift truck is moving horizontally.
 - Personnel in a platform shall have a means to shut the powered industrial truck off.
 - Employees will be trained to use the platform and regarding fall protection, refer to *S3AM-323-PR1 Aerial Work Platforms* and *S3AM-304-PR1 Fall Protection*.
 - If the powered industrial truck is operated by a separate Operator and not by employees within the platform, Operator of the powered industrial truck shall be trained and verified as competent to lift workers in a personnel platform.
 - Coordination between the Operator and Employees in the platform will be established, refer to *S3AM-323-PR1 Aerial Work Platforms*.

4.5 Loading and Moving Material

- 4.5.1 Do not exceed the rated capacity of the powered industrial truck or of any attachments. Attachments shall have a load rating plate affixed indicating the weight that may safely be carried.
 - Only stable or safely arranged loads will be handled.

- A load-engaging means will be placed under the load as far as possible.
 - Confirm forks are spread correctly to support the load.
 - Forks shall be engaged to at least two thirds the length of the load.
 - The mast will be carefully tilted backward to stabilize the load.
 - Confirm load being transported on the fork-lift does not project above the fork carrier or back rest a distance greater than half the height of the unit load.
 - A loose load shall not project above the fork carrier or back rest.
 - The long or high (including multiple-tiered) loads which may affect capacity will be adjusted.
 - Carry load as low as possible.
 - Caution will be exercised when handling off-center loads which cannot be centered.
 - Place heavy objects with the weight as low as possible.
 - Only lift the load vertically; never drag or tow a load horizontally
- 4.5.2 Block or tie objects as necessary to prevent tipping or rolling.
- 4.5.3 Ground personnel shall remain clear and out of the line of fire of material being loaded or moved by a power industrial truck to avoid struck by / struck against hazards.
- 4.5.4 Powered industrial trucks equipped with attachments will be operated as partially loaded trucks when not handling a load.
- 4.5.5 Do not load objects to a height that blocks the view of the Operator. If the load is obstructing the operator's view, then back the truck using a qualified spotter.
- 4.5.6 In a congested work area, use a qualified spotter to direct the Operator.
- 4.5.7 Be aware that freely suspended loads can exert additional dynamic forces which could affect the powered industrial truck's stability. Use tag lines when required.
- 4.5.8 Be cautious of overhead power lines when elevating a load. Maintain the applicable safe limit of approach distance and incorporate appropriate control methods to prevent contact.
- 4.5.9 Do not raise or lower a powered industrial truck's lifting devices while the truck is in motion.
- On grades, tilt the load back slightly and raise it only as far as is needed to clear the road surface.
 - For grades in excess of 10 percent, keep the load pointed upslope when ascending or descending. Extreme care will be used when tilting the load forward or backward, particularly when high tiering.
 - Tilting forward will only be permitted during load pick-up or when depositing on a rack or stack.
 - Tilting backwards will only be permitted to stabilize a load.
- 4.5.10 If using a powered industrial truck to load or unload materials from a trailer or rail car, confirm that their brakes are set and that wheel blocks have been set prior to loading or unloading. Inspect the flooring of trailers and rail cars for breaks or weakness prior to driving onto them.
- 4.5.11 Confirm that dock boards and/or bridge plates are properly secured before being driven over. Drive over dock boards and bridge plates slowly. Never exceed the rated capacity of a dock board or bridge plate.
- 4.6 Service and Maintenance
- 4.6.1 Turn off engines before filling or replacing fuel tanks or recharging/replacing batteries. Confirm that "No Smoking" signs are posted in refueling and/or recharging areas. Immediately clean up any fuel, oil, or electrolyte leaks.

- 4.6.2 Provide appropriate personal protective equipment to personnel assigned to charging and changing batteries, including, but not limited to, eye protection, protective barrier creams, protective clothing, safety boots, gloves, and respiratory protection.
- 4.6.3 Battery charging locations shall be provided with facilities for:
 - **An** eye wash station within the immediate area for emergency use if the charging station presents a risk of exposure to battery acid;
 - Flushing and neutralizing spilled electrolyte;
 - Fire protection;
 - Protection of charging apparatus; and
 - Adequate ventilation for dispersal of fumes.
- 4.6.4 Remove powered industrial trucks in need of repair from service until restored to a safe operating condition. Repairs may only be completed by qualified maintenance personnel or organizations.
- 4.6.5 Disconnect (lockout/tagout) power sources before repairs can be started. Refer to *S3AM-325-PR1 Lockout Tagout* for additional information.
- 4.6.6 Modifications, additions, or attachments that will affect the capacity and safe operation of the powered industrial truck are prohibited without the written approval and new capacity chart provided by the manufacturer.
- 4.6.7 Manufacturer approval is required if the powered industrial truck will be used as a work platform.
- 4.6.8 Powered industrial trucks shall be maintained in accordance with manufacturer's instructions and inspections conducted in accordance with any local regulatory requirements.
- 4.7 Hazardous Atmospheres
 - 4.7.1 Classify the atmosphere of a work location as to whether it is hazardous or non-hazardous prior to considering which designation of powered industrial truck to use in the area.
 - 4.7.2 Do not use powered industrial trucks in atmospheres containing hazardous concentrations of acetylene, butadiene, ethylene oxide, hydrogen (or gases or vapors equivalent in hazard to hydrogen, such as manufactured gas), propylene oxide, acetaldehyde, cyclopropane, diethyl ether, ethylene, isoprene, or unsymmetrical dimethyl hydrazine (UDMH).
 - 4.7.3 Do not use powered industrial trucks in atmospheres containing hazardous concentrations of aluminum (and its commercial alloys), magnesium (and its commercial alloys), or other metals of similarly hazardous characteristics.
 - 4.7.4 A list describing the use of powered industrial trucks in hazardous atmospheres by truck designation is provided in *S3AM-324-ATT1 Powered Industrial Truck Designations*.
 - 4.7.5 Evaluate carbon monoxide concentrations to confirm that they do not exceed published exposure limits when using fuel-powered trucks in an enclosed area.

5.0 Records

- 5.1 None

6.0 Attachments

- 6.1 [S3AM-324-ATT1](#) [Powered Industrial Truck Designations](#)
- 6.2 [S3AM-324-FM1](#) [Pre-Operation Powered Industrial Truck Checklist](#)
- 6.3 [S3AM-324-FM2](#) [Powered Industrial Truck Skill Evaluation](#)

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Pre-Operation Powered Industrial Truck Checklist

S3AM-324-ATT1

The operator will inspect all applicable items indicated at the start of each shift. If an unsatisfactory condition is observed, immediately suspend operation of the truck and report the unsatisfactory condition to the site supervisor.

Mark the box in line with the inspected item under the given day with:

- **Operator's initials** if the inspected item is **satisfactory**
- **N/A** if the inspected item is **not applicable** to the powered industrial truck inspected
- **X** if the inspected item is found to be **deficient**

Week of:		Inspected By:						
Truck ID:								
Visual Checks	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Comments
TIRES – Inflated and free of damage								
FORKS & MAST – Not bent, worn or cracked								
LOAD BACK REST EXTENSION – In place, not bent, cracked or loose								
FIRE EXTINGUISHER – Mounted, charged, not damaged								
ATTACHMENTS – Correctly installed, not damaged								
BODY – Free of excess grease, oil or lint								
GRAB HANDLES								
OVERHEAD GUARD								
HYDRAULIC OIL – Full and free of leaks								
BATTERY – Emergency disconnect functions properly								
BATTERY – Vent caps, connector covers, cables								
BATTERY – Connections tight, charged, tested								
COVERS – Secure over battery and other hazardous areas								
LOAD RATING PLATE – Present and readable								
WARNING DECALS – Present and readable								
SEAT BELT – Accessible and not damaged								

Week of:		Inspected By:						
Truck ID:								
Visual Checks	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Comments
ENGINE – Runs smooth and quiet, no leaks								
OIL – Proper pressure, adequate level								
RADIATOR – Proper level								
HORN – Operates								
TURN SIGNAL – Operates smoothly								
LIGHTS – Work and aimed correctly								
GAUGES and INSTRUMENTS – Working correctly								
LIFT / LOWER – Operates smoothly, no excess drift								
TILT – No excess drift, operates smoothly								
CONTROL LEVERS – Labeled, not loose and freely return to neutral								
STEERING – Smooth and responsive								
BRAKES – Function smoothly without grabbing, no fluid leaks								
PARKING BRAKE – Will hold truck on an incline								
BACKUP ALARM – Working conditions								
MIRRORS – Clean, undamaged, adjusted								
BACKUP ALARM – Working condition								
LPG COMPLIANCE PLATE – Present and readable								
Other Comments:							PPE Required:	
							SAFETY BOOTS MUST BE WORN CAUTION EAR PROTECTION MUST BE WORN	

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Powered Industrial Truck Skill Evaluation

S3AM-324-ATT1

Date _____ Employee Name _____ Evaluator _____

Powered Industrial Truck Type _____

Description:

Operates a powered industrial truck with attached forks or attachments. Utilizes controls to travel and manipulate, load and unload materials from and onto trucks, in warehouse(s) and around work sites.

STEPS	KEYPOINTS	SATISFACTORY
1)	PPE & Safety Awareness a) Is qualified to operate equipment b) Utilizes appropriate personal protective equipment (e.g. seatbelt, hardhat, safety boots, safety glasses, etc.) c) Site / hazard assessment conducted d) Knows machine cautions, notes and warnings e) Operator's manual is available on the vehicle f) Utilizes grab rails, safety treads, equipment ladders g) Procedure reviewed prior to operation	<input type="checkbox"/> Yes <input type="checkbox"/> No
2)	Pre-shift inspection using S3AM-324-FM1 Pre-Operation Powered Industrial Truck Checklist. a) Maintain three points of contact while entering and exiting the equipment b) Pre-start checks i) Ensures brakes are applied ii) Ensures system operating pressures are completely dissipated iii) Controls are in neutral iv) Removes keys from ignition for safety b) Walk around i) Conducts methodical "walk around" to observe inspection items ii) Makes note of deficiencies and addresses accordingly iii) Machine cleanliness inside and out iv) Checks ground conditions v) Make sure area around truck is clear of people and other equipment vi) Check for fire extinguisher vii) Distinguishes when truck should not be operated c) Startup i) Starts equipment and has control ii) Allows equipment to "warm up" in accordance with operator's manual iii) Conducts equipment and system checks to complete inspection iv) Makes note of deficiencies and addresses accordingly v) Distinguishes when truck should not be operated d) Notify supervision of any equipment that is not operational e) The operator can park a piece of equipment that is unsafe to operate if it poses a danger or hazard to employees or property f) Clearance checks i) Assigns spotter in congested areas ii) Uses proper signals and ensures spotter understands iii) Ensures personnel in the area are warned and stay clear	<input type="checkbox"/> Yes <input type="checkbox"/> No
3)	Demonstrated abilities a) Identification of equipment controls b) Selects correct controls and monitors movements c) Travels at safe speed d) Checks clearances in all directions e) Completes task(s) in logical sequence f) Gives right of way to pedestrians g) Uses appropriate path of travel	<input type="checkbox"/> Yes <input type="checkbox"/> No

h) Understands turn radius limitations i) Correctly installs attachment(s) j) Ensures adequate nighttime lighting	
4) Loading techniques a) Approaches load correctly b) Use of attachments i) Proper attachment utilized (e.g. bucket, forks, jib, etc.) ii) Proper load positioning and load securement iii) Competently moves material / load – correct tilt / angle iv) Tag lines used	<input type="checkbox"/> Yes <input type="checkbox"/> No
5) Control handling of materials a) Move and stack materials around site / warehouse b) Offloading / loading shelves or truck / trailer beds c) Repositions as necessary for next load or task d) Utilizes spotter as necessary and understands signals	<input type="checkbox"/> Yes <input type="checkbox"/> No
6) Shifting and traveling	<input type="checkbox"/> Yes <input type="checkbox"/> No
7) Proper use of outriggers, if applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No
8) Parking and shut down procedures a) Equipment line-up i) Straight line ii) Allow easy access for maintenance and servicing b) Turn off all accessories c) Lower bucket to the ground; hydraulics dissipated d) Shuts down truck in accordance with operator's manual e) Air pressures are bled f) Place and position wheel chocks g) Perform a general walk around looking for maintenance items; log deficiencies	<input type="checkbox"/> Yes <input type="checkbox"/> No
9) Evaluated included operation in a warehouse	<input type="checkbox"/> Yes <input type="checkbox"/> No
10) Evaluated included operation on a work site	<input type="checkbox"/> Yes <input type="checkbox"/> No

Employee Signature _____

Evaluator Signature _____

Supervisor Signature _____

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Powered Industrial Truck Designations

S3AM-324-ATT1

Designation	Description
D	Diesel powered units having minimum acceptable safeguards against inherent fire hazards
DS	Diesel powered units provided with additional safeguards to the exhaust, fuel, and electrical system
DY	Diesel powered units provided with DS unit safeguards which have no electrical equipment (including ignition) and are equipped with temperature limitation features
E	Electrically powered units having minimum acceptable safeguards against inherent fire hazards
ES	Electrically powered units provided with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperatures
EE	Electrically powered units that have the electric motor and all other electrical equipment completely enclosed
EX	Electrically powered units in which electrical fittings and equipment are so designed, constructed, and assembled that the units may be used in certain atmospheres containing flammable vapors or dusts
G	Gasoline powered units having minimum acceptable safeguards against inherent fire hazards
GS	Gasoline powered units provided with additional safeguards to the exhaust, fuel, and electrical systems
LP	Liquefied petroleum gas powered units having minimum acceptable safeguards against inherent fire hazards
LPS	Liquefied petroleum gas powered units provided with additional safeguards to the exhaust, fuel, and electrical systems

Designation	Hazardous Location
D	Piers, wharves, general storage, industrial or commercial properties with no hazardous atmospheres
DS	<ul style="list-style-type: none"> Storage of hazardous liquids in sealed containers Storage of liquefied or compressed gases in containers Storage or handling of easily ignitable fibers Any location designated for D units
DY	<ul style="list-style-type: none"> Areas where volatile flammable liquids or gases are handled, processed, or used, but in which the hazard is normally contained within a closed container or system Areas where deposits or accumulations of ignitable dusts are sufficient to be ignited by arcs or sparks originating from the truck Areas where ignitable fibers or flyings are present, but are not likely to be present in quantities to produce ignitable mixtures Any location designated for DS units
E	Piers, wharves, general storage, industrial or commercial properties with no hazardous atmospheres
ES	<ul style="list-style-type: none"> Storage of hazardous liquids in sealed containers Storage of liquefied or compressed gases in containers Storage or handling of easily ignitable fibers

Designation	Hazardous Location
	<ul style="list-style-type: none"> Any location designated for E units
EE	<ul style="list-style-type: none"> Areas where volatile flammable liquids or gases are handled, processed, or used, but in which the hazard is normally contained within a closed container or system Areas where deposits or accumulations of ignitable dusts are sufficient to be ignited by arcs or sparks originating from the truck Areas where ignitable fibers or flyings are present, but are not likely to be present in quantities to produce ignitable mixtures Any location designated for ES units
EX	<ul style="list-style-type: none"> Areas where combustible dust is or may be in suspension constantly, intermittently, or periodically under normal conditions in quantities sufficient to produce explosive or ignitable mixtures (typically includes grain, flour, starch, or other organic dust-producing facilities; coal pulverizing plants; metal dust and powder producing facilities; and other similar locations) Any location designated for EE units
G	Piers, wharves, general storage, industrial or commercial properties with no hazardous atmospheres
GS	<ul style="list-style-type: none"> Storage of hazardous liquids in sealed containers Storage of liquefied or compressed gases in containers Storage or handling of easily ignitable fibers Any location designated for G units
LP	Piers, wharves, general storage, industrial or commercial properties with no hazardous atmospheres
LPS	<ul style="list-style-type: none"> Storage of hazardous liquids in sealed containers Storage of liquefied or compressed gases in containers Storage or handling of easily ignitable fibers Any location designated for LP units

Americas

Lock & Tag Log

S3NA-325-FM1

Name of Qualified Person: _____ Job Name: _____ Date: _____

Job Description: _____ Job Location: _____

TAG NUMBER	LOCK NUMBER	AUTHORIZED EMPLOYEE	LOCATION USED	COMPONENT AFFECTED	DATE/TIME ATTACHED	DATE/TIME REMOVED

Name of Qualified Person (print) : _____ Signature: _____ Date: _____

Name of Supervisor / Manager (print) : _____ Signature: _____ Date: _____

Lock & Tag Log (S3NA-325-FM1)

Revision 0 March 1, 2016

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Lockout Tagout

1.0 Purpose and Scope

- 1.1 Establishes the requirements to perform hazardous energy control through lockout and tagout (LOTO) operations.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.
- 1.3 All AECOM work is regulated by this procedure when:
 - 1.3.1 An unexpected energization or start-up of machines and/or equipment would result in the release of stored energy which could cause injury to an employee.
 - 1.3.2 Any employee (or contractor) is required to remove or bypass a guard or other safety device.
 - 1.3.3 Any employee (or contractor) is required to place any part of his body into the mechanism of a piece of equipment or path of hazardous energy.

2.0 Terms and Definitions

- 2.1 **Affected Employee** – A trained person whose job requires him/her to operate or use a machine or piece of equipment on which servicing or maintenance is being performed under LOTO, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed. The Affected Employee is not performing work under LOTO, but rather is potentially affected by the work being performed by the Authorized Employee(s).
- 2.2 **Authorized Employee** – A person who is appropriately trained and handles LOTO of a machine, piece of equipment or system in order to perform servicing, construction or maintenance on that machine, system or equipment.
- 2.3 **Cord and Plug-connected Equipment** – Equipment where the only energy source is electrical power provided by a plug-in connection.
- 2.4 **Energy Source** – Include, but are not limited to, any electrical, mechanical, hydraulic, pneumatic, chemical, radiation, thermal, or compressed gas energy source; fluid systems; flammable systems; energy stored in springs; and potential energy from suspended objects (gravity) that may injure personnel, cause property damage, and/or cause a release of hazardous substance to the environment.
- 2.5 **Energized** – Connected to an energy source or containing residual or stored energy.
- 2.6 **Energy-isolating Device** – A mechanical device that physically prevents the transmission or release of energy. This includes locks, hairpins, tongs, lockable valves, clamshell devices for valves, blank flanges for piping systems, and restraining devices to prevent movement of parts.
- 2.7 **Isolation** – A physical activity using a device that prevents the transmission or release of energy. Examples of devices used to isolate equipment/systems include, but are not limited to restraint blocks, electrical circuit breakers, disconnect switches, fuses, slip gates, slip blinds, or double valves. Control circuit devices, motor controllers, etc., are NOT acceptable isolation devices.
- 2.8 **Locking Device** – A device that utilizes a lock, key to hold an energy-isolation device in the safe position for the purpose of protecting personnel.
- 2.9 **Lockout** – The use of a locking device to confirm that an energy-isolating device and the equipment it controls cannot be operated until the lockout device is removed.
- 2.10 **Lockout / Tagout- (LOTO) Specific Procedure** – A written procedure developed specifically for each piece of machinery or equipment capable of unexpectedly releasing energy. This procedure outlines in detail of how LOTO will be performed.

- 2.11 **Normal Production Operations** – The utilization of a machine or piece of equipment to perform its intended production function.
- 2.12 **Qualified Person** – A person, familiar with the construction and operation of the equipment and the hazards involved, trained and competent in the applicable LOTO procedures and assigned authority for the coordination and overseeing of Authorized Employee(s) implementation of LOTO protection. A Qualified Person may be referred to by a different term depending upon jurisdiction (e.g. Requesting Authority, Lockout Authority, Person in Charge, etc.).
- 2.13 **Servicing and/or Maintenance** – Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment, and making adjustments or tool changes where employees could be exposed to the unexpected energization or start-up of the equipment or a release of hazardous energy.
- 2.14 **Tagout** – Use of a warning device, such as a tag and its means of attachment, to establish that an energy-isolating device and the equipment it controls may not be operated until the tagout device is removed.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation
- 3.3 S3AM-209-PR1 Risk Assessment & Management
- 3.4 S3AM-218-PR1 Permit to Work

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Managers

- Provide LOTO training to Employees engaged in tasks covered by this procedure.
- Prepare and implement LOTO procedures on their locations / projects.
- Confirm appropriate and adequate lockout equipment is available for their location / project.
- Determine LOTO responsibilities (AECOM, contractor or client).
- Consult with the Safety, Health and Environment (SH&E) Department regarding project / location -specific requirements for LOTO.
- Inform the authorized and affected employees about the client or facility's LOTO requirements.
- Confirm only trained employees perform LOTO procedures while working in areas requiring hazardous energy control.
- Confirm the 'Removal of Unattended LOTO Devices' procedure is followed when necessary.
- Confirm that the site-specific written LOTO procedure is audited at least annually including the observation of workers performing the procedure.

4.1.2 Qualified Person

- Only employees who have completed LOTO Performance training and Competent Person (LOTO) training may be designated as a Qualified Person. Refer to *S3AM-003-PR1 SH&E Training*.
- Verify with the Manager who is responsible for LOTO at client facilities or sites.
- Shut-down equipment or request de-energizing of an energy source.

- Inspect de-energizing with the Authorized Employee(s).
- Confirm that the Authorized Employee(s) has locked and tagged the source.
- Require that all applicable Authorized Employees affix lock/tags at the same location(s).
- Operate the equipment controls or otherwise verify that the equipment cannot be restarted after being locked out.
- Coordinate the continuation of LOTO protection through shift or personnel changes.
- Control accountability of locks and tags.
- Make appropriate entries on the *S3AM-325-FM1 Lock & Tag Log* or equivalent. Where the number of energy control activities is extensive or the scope of energy controls is complex, the qualified person may choose to use the *S3AM-325-FM4 Lockout Tagout Permit* as an aid.
- Conduct tests and visual inspections prior to reenergizing to check that circuits and equipment can be safely energized.
- May be referred to by different terms depending upon jurisdiction (e.g., Requesting Authority, Person in Charge, Lockout Authority, etc.).

4.1.3 **Supervisor (or competent designate)**

- Confirm that all Affected Employees and Authorized Employees under their direction are fully aware of, trained in, understand, and adhere to the LOTO procedures applicable to the task at hand.
- Identify when and where potential energy sources require lockout tag out to control unexpected energy release (consult client representatives, operators, equipment manuals, manufacturers, Qualified Person, etc.)
- Approve developed and written LOTO procedures.
- As applicable, confirm client requirements or programs are incorporated into the LOTO procedures.
- Document and investigate any identified LOTO procedural deficiencies.
- Confirm all on-site affected employees are informed of the procedure(s) used to control potential energy sources in order to prevent unexpected release.
- As applicable, act as the Qualified Person.
- Confirm the 'Removal of Unattended LOTO Devices' procedure is followed when necessary.

4.1.4 **Authorized Employees**

- Only **Authorized** Employees who have completed LOTO Performance training will be permitted to perform LOTO procedures and to work under LOTO procedures. Refer to *S3AM-003-PR1 SH&E Training*.
- Verify with the Manager who is responsible for LOTO at client facilities or sites.
- Obtain lock(s), key(s) and tag(s).
- Meet with facility representatives, Qualified Person and Affected Employees to review the LOTO activities.
- Implement project / site-specific LOTO procedures.
- Review any equipment-specific LOTO procedures prior to initiating work on the equipment.
- Any procedural deficiencies shall be immediately reported to the Supervisor and logged as an incident in IndustrySafe, refer to the *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*. No further work will be permitted on the equipment until procedures are amended.

4.1.5 **Affected Employees**

- Complete LOTO Awareness training. Refer to *S3AM-003-PR1 SH&E Training*.
- Support Authorized Employees with the safe shutdown and restart of equipment.
- Assure that no attempt is made to restart equipment without the knowledge of all Affected Employees and Authorized Employees performing work on the equipment.

4.1.6 **Employees**

- Refrain from making any attempt to restart equipment that is LOTO.
- Avoid areas where Authorized Employees are working on equipment.

4.2 **Training**

4.2.1 The Manager shall orientate all Employees to the location or project specific SH&E plan and Task Hazard Assessment (THA) requirements, in accordance with *S3AM-209-PR1 Risk Assessment & Management*, and confirm training requirements are met prior to work starting. Proof of training and orientation shall be documented and retained in the location / project or SH&E Department files. Qualified Person(s), Authorized Employees, Affected Employees, and their Supervisors and Managers will be trained in the following areas before being involved in de-energizing or shut-down of equipment, LOTO, affected by LOTO or to work on equipment requiring LOTO:

- Recognition of hazardous energy sources;
- Types and magnitudes of energy sources located in the workplace;
- Procedures for energy isolation and control, including specific procedures developed for specific equipment and systems (e.g. valve lockout, electrical lockout, etc.);
- Recognition of when to use LOTO procedures;
- Purpose and use of the energy control (LOTO) procedure, equipment, and devices; and
- Prohibitions and penalties for attempting to restart or re-energize equipment which has been locked out/tagged out, or to work on equipment without following the LOTO procedures.

4.2.2 A Qualified Person is limited to those supervisors and managers, and selected employees who have successfully completed all of the required training per the *S3AM- NA-003-PR1 SH&E Training* requirements (LOTO Performance and Competent Person (LOTO)) and is familiar with the construction and operation of the proposed equipment and the hazards involved.

4.2.3 Authorized Employees will be trained in the purpose and use of the LOTO procedure training per the *S3AM- NA-003-PR1 SH&E Training* requirements (LOTO Performance). Authorized Employees shall also be adequately training and competent in relation to the skills required to perform the LOTO procedure (e.g. all electrical work shall be performed by a qualified electrician)

4.2.4 Affected Employees will be trained in the purpose and use of the LOTO procedure training per the *S3AM- NA-003-PR1 SH&E Training* requirements (LOTO Awareness).

4.2.5 All Employees whose work operations may be in an area where LOTO procedures may be utilized will be trained about the procedure and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out/tagged out. These personnel are not required to be familiar with specific procedures for equipment and systems.

4.2.6 Retraining or refresher training for a Qualified Person, Authorized Employees and/or Affected Employees will be conducted annually or whenever one of the following exists:

- The Employee has a change in job assignment;
- There has been a change in the equipment or process;
- There has been a change in the energy-control procedure or new hazards arise;
- When evaluation of applied LOTO procedures reveals a need for additional training; and/or

- An incident occurs as a result of unexpected energy release.

4.2.7 Training Documentation

All employee training, including refresher training, will be documented in accordance with *S3AM-003-PR1 SH&E Training*. Employee training records will include type of training, date, and employee name. These records will be maintained for each Employee for the duration of their employment. Each office and project site shall maintain a current list of personnel trained in accordance with the designations; Qualified Person, Authorized Employees and Affected Employees.

4.3 Lockout Tagout Equipment

4.3.1 Locks

- Locking devices shall meet the following criteria:
 - Be traceable to an individual person using a tag, picture, number or other unique identifier.
 - Be marked in such a way so as to distinguish the LOTO locks from locks used for any other purpose.
 - Be made of durable non-conducting material.
 - Be substantial and secured in such a way as to prevent inadvertent removal without excessive force.
 - Be standardized within the facility (color, shape or size) and placed in a conspicuous location.
 - Shall NOT be a combination style lock. Shall be a keyed lock.
- Keyed requirements may vary per jurisdiction and client requirements. Examples:
 - Each lock to be keyed differently and have only one key in existence held by the Authorized Employee.
 - Each lock to be keyed differently with two keys available:
 - One key in the possession of the Authorized Employee responsible for applying and removing the lock .
 - The second key shall be strictly controlled by a person authorized and trained to use the duplicate key in accordance with Emergency Lock Removal or Unattended LOTO Device procedures (e.g. Qualified Person, Supervisor, etc.).
 - Multiple locks keyed to one key:
 - The locks are applied to lockout all aspects of the system by the Qualified Person and the key placed inside a group lockbox.
 - After all Authorized Employees have verified the system as completely locked out, each Authorized Employee applies his/her individual lock to the lockbox.

4.3.2 Tags

- Tags shall accompany locks and are to be placed at the same point as the lock.
- The tag's means of attachment shall be substantial and secured in such a way as to prevent inadvertent removal. The attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable.
- Tags shall be constructed to withstand environmental conditions (i.e. weather, chemicals, etc.) and printed to confirm the message remains legible. Tags shall contain the following information:
 - Warning(s) (e.g. DO NOT OPERATE, DO NOT OPEN, etc.).

- Name of the person responsible for the device.
- Tags are to be consistent within the facility / site in color, shape, or size, and with print and format standardized. In addition to containing warnings and the responsible person's name, the tag format may contain further information such as, but not limited to:
 - Company name.
 - Reason for LOTO.
 - Work being completed.
 - Date and time of initial lockout.
 - Supervisor's name.
 - Emergency phone numbers.
- Where lockout with a keyed lock is not possible, a tag(s) containing the above mentioned information shall be in place (e.g. steering wheel lockout) at the point of isolation or as close as safely possible.
 - The tag shall be highly visible and adequately identify the point of isolation and the associated hazards.

4.3.3 Other Lockout Equipment

- Multiple lockout device
 - Utilized where various Authorized Employees will be working on a machine, equipment or system.
 - The multiple lockout device is applied to the point of isolation or to a lockbox, with each Authorized Employee applying his/her individual lock to the multiple lockout device.
- Lockbox
 - Use of the lockbox is coordinated by the Qualified Person.
 - Utilized where various Authorized Employees will be working on a machine, equipment or system.
- *S3AM-325-FM1 Lock & Tag Log* or equivalent.
- Additional equipment to adequately secure the point of isolation. Examples:
 - Chains
 - Lockout pins
 - Plug lockouts
 - Pneumatic lockout devices
 - Lockout bags
 - Valve lockouts
 - Toggle locks
 - Electrical socket lockouts
 - Blanks and blinds

4.4 General LOTO Procedures

- 4.4.1 Only Authorized Employees trained in lockout/energy control procedures will be involved with the locking out, de-energizing and control of all potential sources of energy on energized systems.

- 4.4.2 Written procedures for lockout and energy control shall be developed and approved by the Supervisor and shall be implemented prior to performing work. Where client requirements and programs exist, AECOM procedures shall incorporate them and shall be compatible with them.
- 4.4.3 The site, project or client-specific procedures shall be understood and followed for the health and safety of all staff affected by or involved with the locking out, de-energizing and control of all potential sources of energy prior to the performance of work on energized systems.
- 4.4.4 No work shall be initiated (including LOTO procedures) prior to obtaining any required permits. Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
- 4.4.5 The site specific emergency response plan shall be in place and reviewed with all affected personnel potentially affected.
- 4.4.6 Be aware of the type and magnitude of all potential energy sources, such as:
 - Chemical,
 - Hydraulic,
 - Radiological,
 - Electrical,
 - Mechanical,
 - Residual,
 - Gravitational,
 - Pneumatic,
 - Thermal, and
 - X-ray testing of pipes.
- 4.4.7 It is the responsibility of Managers and/or Supervisors to identify through meetings with Client representatives when and where their work requires the isolation and control of an energy source.
- 4.4.8 The Manager and/or Supervisor shall:
 - Determine whether more than one Authorized Employee or crew will be working on the machine or equipment. As applicable, establish the Qualified Person(s).
 - Evaluate the potential for Authorized Employees on multiple shifts to be working on the equipment. If multiple shifts will be working on the same equipment consult the section 'Shift Change Procedures.'
 - Identify and communicate to all Affected Employees and to all Employees whose work operations may be in an area where LOTO procedures may be utilized:
 - The associated energy source(s) of the machine(s), equipment or system that will be de-energized and isolated. Note that more than one source of energy may be involved with each machine, piece of equipment or system.
 - The hazards of the identified energy sources.
 - How the energy will be isolated and brought to a zero energy state.
 - How the energy will be locked out of service, tagged and tested to verify the effectiveness of the controls.
- 4.4.9 Where the procedures are affected by the facilities or workers of the client, procedures will follow the requirements of and be approved by the client.
- 4.4.10 Where there is a danger of energy being released or equipment or systems being energized:
 - Shut down machine/equipment by normal stopping procedure and confirm that the controls are in a neutral position (off).

- Disconnect the main sources of power by breaking the primary circuit, valve, pipe, etc.
 - Each separate energy source shall be disconnected, or in the closed, locked or controlled position.
 - The motor switch on all individual motor drives shall be locked in the off position.
 - Locking out a low voltage control circuit is not considered breaking a main power source.
- 4.4.11 Release all residual energy remaining behind the power source (e.g. hydraulic, or air pressure). If there is a possibility of re-accumulation of stored energy level, verify isolation until the task is complete or the possibility no longer exists. Use the following methods to guard against energy left in equipment after it has been isolated: .
- Inspect the system to confirm that all parts have stopped moving.
 - Install grounding wires.
 - Relieve trapped pressure.
 - Release the tension of springs or block the movement of spring-driven parts.
 - Block or brace parts that could fall because of gravity.
 - Bleed pneumatic and hydraulic systems and leave vent valves open. Block parts in hydraulic and pneumatic systems that could move from loss of pressure.
 - Drain process piping systems and close valves to prevent the flow of hazardous materials.
 - Use blank flanges on lines without valves that shall be blocked.
 - Purge reactor tanks and process lines.
 - Dissipate extreme heat or cold when possible.
 - Remove fuses from electrical circuits.
 - Monitor situations where there is a potential for stored energy to re-accumulate.
- 4.4.12 Each Authorized Employee shall affix their own individual lock and tag in a manner that will hold the energy-isolating device in a safe or off position.
- 4.4.13 NOTE: Locks and tags by themselves do not de-energize machinery, equipment or systems. Attach them only after isolation from the energy source(s).
- 4.4.14 If more than one employee is involved in the LOTO procedure (group lockout) for the given machinery, equipment or system:
- The locks, tags and isolation points are documented by the Supervisor or the Qualified Person using *S3AM-325-FM1 Lock & Tag Log* or equivalent.
 - Each Authorized Employee shall apply his/her own individually identifiable lock to a LOTO device capable of accepting multiple locks at the isolation point(s), OR
 - Energy isolation and LOTO may be performed by the Qualified Person.
 - The Qualified Person applies the locks and tags at the various isolation points. Depending upon the jurisdiction or client requirements, two Qualified People may be required to apply the locks and tags.
 - After each involved Authorized Employee has verified the system as completely lockout out by the Qualified Person(s), the key(s) to the isolation point lock(s) is placed in a lockbox.
 - Each Authorized Employee applies his/her own individually identifiable lock to the lockbox.
 - Attach the *S3AM-325-FM1 Lock & Tag Log* or equivalent, to the outside of the lockbox.

- 4.4.15 NOTE: In cases of complex group lockout scenarios; (multiple group lockouts, use of additional locks/lockout devices beyond the available keyed alike locks etc.), an equipment/site specific procedure(s) shall be developed by a competent/qualified worker and reviewed and implemented by all involved Authorized Employees to achieve a zero energy state.
- 4.4.16 Test the machine(s), equipment or system(s) prior to working on it to verify all sources of energy have been isolated. Examples include, but are not limited to:
- Verifying that the main disconnect switch or circuit breaker can't be moved to the "on" position.
 - Depressing all start buttons and activating controls.
 - Using a voltmeter to check for potential energization sources.
- 4.4.17 Under no circumstances is an Authorized Employee allowed to work on machinery, equipment or systems that do not contain their own lock (even if the energy is isolated and locked and tagged by another employee). Authorized Employees shall work only on protected source(s) to which they have applied their individual lock (at the isolation point(s) or on the associated lockbox).
- 4.4.18 Locks and tags will remain in place until the work has been completed.
- 4.4.19 The locks, tags, and equipment shall not be tampered with by any Employee.
- 4.4.20 Only the Authorized Employee placing the lock and tag may remove the lock and tag.
- 4.4.21 If the Employee who placed the LOTO device/sign subsequently no longer works for the company, cannot be located or a LOTO device/sign shall be removed due to an emergency, the Supervisor and/or Qualified Person (and as applicable, the Client Contact) shall be notified and the removal shall follow the procedures in accordance with appropriate section 'Removal of Unattended LOTO Devices' or 'Emergency Lock Removing Procedures'.
- 4.4.22 Preparing to Re-energize
- 4.4.23 The following steps shall be taken for temporary operation of a locked out energy source or when restarting a machine, piece or equipment or system in order to place back in service:
- Confirm the task (maintenance, construction, repair) is complete. If more than one Authorized Employee performed the LOTO, inform the Supervisor (or if applicable, the Qualified Person) that the task is complete.
 - Confirm that tools are picked up, non-essential items removed, equipment components are intact and safety chains, guards, guard rails, warning signs, etc. are replaced. If a guard, guardrails, etc. shall remain off during temporary operation (e.g. maintenance process requires access during operation, to observe or evaluate operation during maintenance or repair, etc.), appropriate control measures shall be established and in place to confirm the safety of all personnel.
 - The Authorized Employee shall notify Affected Employees that the lockout device(s) will be removed. If more than one Authorized Employee performed the LOTO, the Supervisor (or if applicable, the Qualified Person) will confirm the notification of all Affected Employees and Authorized Employees.
 - Remove all locks and tags. This can be done only by the Authorized Employee who applied the lock and/or tag, unless 'Removal of Unattended LOTO Devices' or 'Emergency Lock Removing Procedures' are followed.
 - The Authorized Employee (or, if a group lockout, the Supervisor or Qualified Person) shall complete a thorough inspection of the machinery, equipment, or system and worksite, to confirm the equipment is ready for start-up.
 - Advise all Affected Employees and Authorized Employees that the equipment or process will be restarted.
 - Confirm all personnel are clear of all line of fire zones. Position controls correctly for start-up; machinery, equipment or system may be restarted.

- If the restart was initiated as temporary operation of a locked out energy source, the machinery, equipment or system shall be immediately de-energized, isolated and LOTO procedures completed again immediately following the required temporary operation.

4.5 Shift Change Procedures

- 4.5.1 If ongoing work requires carryover from shift to shift, or transfer of responsibility between Authorized Employees, the following procedure will be implemented:
- The Authorized Employee(s) who originally performed the lockout will walk through the lockout/isolation steps with the new Authorized Employee(s).
 - At each isolation point, the original Authorized Employee shall remove his/her LOTO device(s), to be immediately replaced by the new Authorized Employee's device(s).
 - Upon transfer of the LOTO equipment, the new Authorized Employee(s) shall verify that the equipment is still isolated prior to continuation of work.
- 4.5.2 Under no circumstances shall the original LOTO devices remain in place and just the keys transferred.
- 4.5.3 For a Supervisor and Qualified Person conducting group lockouts, the same procedure shall be used with the oncoming Supervisor or Qualified Person.

4.6 Removal of Unattended LOTO Devices

- 4.6.1 Only the person(s) who placed the LOTO devices on the system can remove the devices, unless:
- The Manager has verified that the Authorized Employee is not on site and is not available to return to the site to remove the lock.
 - All reasonable efforts have been made to contact the Authorized Employee to verify that the work is complete and the devices are about to be removed.
 - The Manager inspects the LOTO device and confirms that the appropriate steps in preparation of safely re-energizing the machinery, equipment or system have been completed.
- 4.6.2 If all of the above apply, the locks and tags will be removed only at the direction of the Manager. The Manager shall complete an *S3AM-325-FM3 Unattended & Emergency Lock Removal Form* or equivalent, to document the event prior to removing the lock and file the form with the project / location files. A copy of the form shall be sent to the SH&E Department member with oversight responsibility for the project / location.
- 4.6.3 The Manager shall confirm the affected machinery, equipment or system is monitored to confirm no one returns while re-energizing.
- 4.6.4 **UNAUTHORIZED REMOVAL OF A LOTO DEVICE WILL RESULT IN IMMEDIATE DISMISSAL FROM THE PROJECT SITE AND POTENTIAL TERMINATION!**
- 4.6.5 The Authorized Employee whose LOTO device was removed shall be informed of the removal prior to resuming work.

4.7 Emergency Lock Removing Procedures

- 4.7.1 This procedure will ONLY be used in an emergency situation defined as an event that may cause injury, fire, explosion, over exposure or other hazards to the general public, the environment or personnel.
- 4.7.2 In an emergency event that requires a lock or tag to be removed by a person other than the Authorized Employee who placed the lock or tag, the following lock-removing procedure will be implemented by the Supervisor or Qualified Person, or by another Authorized Employee under the direction or observation of the Supervisor or Qualified Person:
- As the situation permits, attempt to contact the Authorized Employee whose LOTO device shall be removed.

- Investigate and verify that all equipment and material in relation to the work has been completed and/or put into a safe configuration.
 - Confirm all Authorized Employees have been removed from the hazardous location and all Affected Employees on site are notified.
 - Remove the LOTO device.
- 4.7.3 If not notified prior to lock removal, attempt to contact the Authorized Employee whose lock was removed to advise that the LOTO device has been removed.
- 4.7.4 The Manager shall complete an *S3AM-325-FM3 Unattended & Emergency Lock Removal Form*, or equivalent, to document the event and file the form with the project /location files. A copy of the form shall be sent to the SH&E Department member with oversight responsibility for the project / location.
- 4.7.5 Whenever a LOTO is removed for emergency purposes by anyone other than the Authorized Employee who placed the LOTO, that person and all other Authorized Employees and Affected Employees shall be contacted (immediately if on shift, and prior to the start of their next shift if off shift) to inform them that the equipment/system is no longer locked out/tagged out.
- 4.8 Specific LOTO Procedures
 - 4.8.1 Written procedures will be developed for the LOTO of each piece of equipment that has potentially hazardous energy sources. Refer to *S3AM-325-ATT1 Equipment-Specific LOTO Procedure Template* or equivalent.
 - 4.8.2 Each procedure shall be reviewed and approved by the SH&E Department prior to implementation.
 - 4.8.3 Equipment-specific written LOTO procedures are not required, if ALL of the following conditions are met:
 - The equipment's only energy source is electrical;
 - The unexpected start-up of the equipment is controlled by unplugging the equipment from the electrical source; and
 - The plug or switch is under the exclusive control of the person performing the work.
 - 4.8.4 Additionally, written equipment-specific LOTO procedures are not required if ALL of the following apply:
 - The machine has no potential for stored or residual energy, or re-accumulation of stored energy after shutdown (i.e. contains a capacitor to store electrical energy or pressurized tank to store air/gas);
 - The machine has a single energy source that can be readily identified and isolated;
 - The lockout and isolation of the energy source completely de-energizes and deactivates the equipment;
 - Servicing of the machine requires that its energy source shall previously have been locked out and tagged out in accordance with General LOTO Procedures as provided in this Standard Operating Procedure; and
 - A single lockout device achieves a locked-out condition.
 - 4.8.5 All equipment-specific LOTO procedures will be prepared to meet the following:
 - Equipment-specific LOTO procedures shall be developed in accordance with the requirements of this procedure.
 - Procedures are to involve completion of Form *S3AM-325-FM2 LOTO Verification Checklist* or equivalent;
 - Authorized Employee(s) perform work according to manufacturer's specifications;

- Equipment-specific preparation for re-energizing procedures shall be developed in accordance with General LOTO Procedures as provided in this Standard Operating Procedure;
- Reenergize the machine, equipment or system according to manufacturer's specifications.

4.9 LOTO Procedures (no Equipment-Specific Written Procedure)

4.9.1 In the absence of an equipment-specific LOTO procedure, the following procedures, in combination with a completed Safe Work Plan and/or Task Hazard Analysis can be used as an acceptable substitute.

4.9.2 Process Equipment

- Determine what energy sources are present, such as electrical, gas, pressurized systems (e.g. steam, water, and hydraulics), heated fluids or gas (e.g. steam, hot water), and gravity (e.g. suspended piping).
- Determine which of these sources requires isolation to perform the work.
- Determine the locations where each energy source for the system / piece of equipment can be turned off/isolated AND be locked out. For example, if a machine has an on/off button, pushing the button to the off position is not sufficient isolation, since the button cannot be locked out. The equipment shall either be unplugged and the plug lockout out or the circuit breaker or electrical switch supplying the machine or equipment located, closed and locked out.
- Make sure Employees in the area are aware the equipment is about to be shut-down and locked out, and then close the isolation devices. Once closed, the Authorized Employee(s) lock out the isolation devices so they cannot be inadvertently opened.
- Place an appropriate tag on each lock out device based on the tag requirements.
- Once locked out, verify that the isolation was successful by following manufacturers' directions or standard trade practice. Means of determining whether isolation was successful include, but are not limited to:
 - Attempting to start up equipment,
 - Opening pressure relief valves, and
 - Attempting to ignite the pilot light.
- Complete the *S3AM-325-FM2 LOTO Verification Checklist*, or equivalent.
- Authorized Employee(s) perform the necessary work.
- Confirm all tools and non-essential items are removed from the work area. Confirm removed guards are replaced and equipment/system components are intact.
- Inform Employees in the area that the LOTO systems will be removed
- Authorized Employee(s) remove their individual tag(s) and lock(s) used to isolate the various energy sources.
- Open up each isolation source. For fluid or gas systems, check for leaks at the area the work was performed as necessary.
- Inform Employees in the area that the LOTO systems have been removed.
- If additional work is required (e.g., repair of leak, fine tuning of work), the LOTO procedure shall be re-established. Under no circumstances shall work be performed on the equipment without prior isolation of the energy sources.

4.9.3 Electrical Systems

- In general, AECOM personnel will provide LOTO services in low-voltage situations only (voltage is below 600 volts). Specific procedures for high-voltage situations (above 600 volts), will either be developed by certified AECOM electrical personnel appropriately trained and

competent in high-voltage electrical work or by subcontractor high-voltage operations. Developed high-voltage procedures shall obtain approval from the SH&E Manager. If an electrical subcontractor is utilized, they will be required to provide documentation of their high-voltage certification.

- If the lockout involves a low-voltage (voltage is below 600 volts) electrical system, an Authorized Employee shall be a qualified electrician or , as permitted, an equivalent qualified and competent worker will lockout and de-energize all applicable electrical systems:
 - Identify the disconnect or breaker by matching its name or number for each piece of equipment.
 - Identify any secondary and tertiary systems within the electrical system (i.e. capacitors).
 - Open disconnect or breaker and all other applicable systems; lock them open with multiple-lockout device and tag the lock(s).
 - Where disconnecting devices cannot be locked open, the equipment (electric or mechanical), shall be disabled by removing fuses, breakers or disconnecting wire leads, etc.
 - Appropriate "Danger – Do Not Operate" tag shall be securely placed on the source of electrical or mechanical energy.
 - Removed fuses are not to be left in the general area of the equipment that is to be isolated.
 - All disconnected wires shall have the ends isolated.
 - Verify the power is disconnected by attempting to activate the equipment.
 - All Authorized Employees associated with work requiring the electrical lockout shall be present to witness and verify the test.
 - Confirm all Authorized Employees and Affected Employees are standing clear during this test.
 - If equipment involves a motor:
 - Activate the manual motor control station to confirm the power is disconnected.
 - If equipment is on delay:
 - Wait a predetermined time to confirm the power is disconnected.
- Competent Electrical Worker
 - If it is necessary to test for voltage (e.g. before applying grounds):
 - Prove the integrity of the voltage tester against a known live circuit.
 - Check the voltage between phases and to ground.
 - Re-prove the integrity of the voltage tester against the known live circuit.
- Isolating Electrical Circuits without a Lockout Device
- Note: Only a competent electrical worker may undertake the following steps in accordance with NFPA 70E Standard for Electrical Safety in the Workplace and/or the Canadian Electrical Code.
 - Where reliable lockout mechanisms are not available:
 - Remove the conductors from the breaker.
 - Isolate and protect the bare conductors.
 - Test the disconnected circuit for voltage.

- Identify and tag the circuit.
- When the work is completed:
 - At the completion of the installation, disassembly, repair or maintenance, confirm that all parts and guards are replaced and all tools / equipment are removed.
 - Do not remove locks, replace fuses, etc. until it is verified all personnel are clear of all line of fire zones, the work is finished and a thorough inspection of the equipment and worksite is completed.
 - Removal of personal lock(s) and/or Lock-Out Tag(s) is only to be performed by the Authorized Employee(s) who affixed the tag(s) or lock(s).
 - Remove the "DO NOT OPERATE" sign.

4.9.4 Pressurized Water, Air or Inert Gas(e.g. Nitrogen, Carbon Dioxide, etc.)

- Note that more than one source of energy may be involved with the system. Make sure the equipment to be worked on is turned off / isolated, locked out and tagged out in accordance with the requirements of this procedure.
- Turn off (close) any valve upstream of the work area. Note: if steam or water can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or confirm that all necessary valves have been closed and are functioning properly. If this procedure is being used in preparation of confined space entry, positive isolation (i.e. line break, blind plate, or double-block and bleed) shall be established on both sides prior to authorizing confined space entry.
- Using the appropriate locking device, Authorized Employee(s) lock and tag the valve(s) in the closed position. Confirm the tag contains all pertinent information.
- Allow the system to be worked to cool down (in the case of steam or hot water).
- Once cooled, open any unsecured pressure relief valves and drain any additional fluids from the system. If the system is not equipped with a pressure relief or drain system, make sure the pipes are cool to the touch and slowly open and drain in accordance with standard trade practice.
- Once the system has been reduced to atmospheric pressure, the pipes or lines shall be disconnected, blinded, or closed by a valve and locked out and/or tagged out accordingly. Observe line entry procedures when first opening the line.
- Complete *S3AM-325-FM2 LOTO Verification Checklist* or equivalent.
- Authorized Employee(s) perform the necessary work.
- Confirm all sections are replaced, secure and closed.
- Remove all tools and non-essential items from the work area.
- Inform Employees in the area that work has been completed and equipment is being energized.
- Removal of personal lock(s) and/or Lock-Out Tag(s) is only to be performed by the Authorized Employee(s) who affixed the tag(s) or lock(s).
- Slowly open the valve, stopping when water or steam flow has started. Observe the work performed to make sure no leaks are evident. If leaks are observed, re-close the valve, isolate the system, and follow the steps of this section to reapply and verify the LOTO of the system.
- If no leaks are detected, gradually open the isolation valves to their normal position.

4.9.5 Pressurized Gas (e.g. Natural Gas, Propane, etc.)

- Note that more than one source of energy may be involved with the system. Make sure the equipment to be worked on is turned off / isolated, locked out and tagged out in accordance with the requirements of this procedure.
- Confirm appropriate atmospheric monitoring is in place and maintained as necessary.
- Turn off the valve upstream from the area to be worked on. Note: if gas can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or confirm that all necessary valves have been closed and are functioning properly. If this procedure is being used in preparation of confined space entry, positive isolation (i.e. line break, blind plate, or double-block and bleed) shall be established on both sides prior to authorizing confined space entry.
- Using the appropriate locking device, Authorized Employee(s) lock and tag the valve(s) in the closed position. Confirm the tag contains all pertinent information.
- Confirm all spark sources in the area have been isolated or removed.
- Using non-sparking tools, the Authorized Employee(s) shall remove the remaining gas in the line using standard trade practice. If in an enclosed area, make sure appropriate ventilation is present. If the flow of gas does not stop, then shut down the next upstream valve, or the gas main valve. Each additional valve closed shall be locked out and tagged out.
- Complete *S3AM-325-FM2 LOTO Verification Checklist* or equivalent.
- Authorized Employee(s) perform the required work. If hot work is necessary (e.g. soldering, grinding, welding), confirm the requirements of *S3AM-332-PR1 Hot Work* are followed prior to authorizing work.
- Once work has been completed, make sure that all connections are replaced and secured as required.
- Confirm all tools and non-essential items are removed from the work area.
- Inform Employees in the area that work has been completed and equipment is being energized.
- Removal of personal lock(s) and/or Lock-Out Tag(s) is only to be performed by the Authorized Employee(s) who affixed the tag(s) or lock(s).
- Slowly open the valve, stopping when gas flow has started. Observe the work performed to make sure no leaks are evident.
- Test the work area for leaks using an approved testing solution. If leaks are detected, re-close the valve(s), isolate the system, and follow the steps of this section to reapply and verify the LOTO of the system before additional repairs can be made.
- If no leaks are detected, gradually open the isolation valves to their normal position.

4.9.6 Mobile Equipment

- Mobile equipment being repaired / maintained shall be prevented from being inadvertently started and Employees protected from unexpected movement.
- The Authorized Employee(s) conducting the repairs / maintenance shall remove the keys from the ignition.
- Each Authorized Employee is to fix a Tagout device indicating warning e.g. "DO NOT OPERATE" to the steering mechanism.
- The Tagout Device(s) shall include:
 - Name of Authorized Employee applying the tag
 - Date

- Time
- Location of keys
- Conduct any other necessary isolation procedures (i.e. application of emergency brake, blocking of tires, etc.).
- Verify that there is no stored energy on the piece of equipment that is to be worked on.
- Authorized Employee(s) perform the required work
- At the completion of the repair or maintenance, confirm that all parts and guards are replaced and all tools / equipment are removed.
- Do not remove locks, disengage brakes, etc. until it is verified all personnel are clear of all line of fire zones, the work is finished and a thorough inspection of the equipment is completed.
- At the completion of the repair / maintenance, the Tagout device(s) shall only be removed by the Authorized Employee(s) who affixed the tag.

4.9.7 Mechanical Systems

- Mechanical systems (pumps, turbines, etc.) to be installed, disassembled, repaired, tested or maintained shall be prevented from being inadvertently started or energy released. The Qualified Person or Authorized Employee shall confirm:
- The Qualified Person or Authorized Employee shall confirm motors or engines are turned off / isolated, locked out and tagged out in accordance with these procedures.
- Note that more than one source of energy may be involved with the system.
- The Authorized Employee(s) shall apply personal lock(s) and tag(s) to the starting mechanism when possible. If not possible affix Tagout device(s) indicating warning e.g. "DO NOT OPERATE" to the starting mechanism of the motor or engine.
- The Tagout device is to include:
 - Name of individual applying the tag
 - Date
 - Time
- The Authorized Employee(s) shall apply any applicable brakes, pawls or other manufacturer installed isolation devices.
- Authorized Employee(s) lockout and tag all applicable mechanical equipment (e.g. valves) using lockout devices such as, but not limited to:
 - Securing hazardous parts to other fixed and immobile parts.
 - Chain secured through valves or handles at required position.
 - Blanking and blinding.
- Authorized Employee(s) restrict the movement of any other parts that could release stored energy (i.e. sheaves, counterweights, etc.) and provide secondary isolation where necessary through measures such as, but not limited to:
 - Securing hazardous parts to other fixed and immobile parts.
 - Support or isolation of hazardous parts through the use of rigging attached to hoisting equipment, winch lines, etc.
- Verify that there is no stored energy on the piece of equipment that is to be worked on.
- Authorized Employee(s) perform the required work

- At the completion of the installation, disassembly, repair or maintenance, confirm that all parts and guards are replaced and all tools / equipment are removed.
- Do not remove locks, disengage brakes, open valves, etc. until it is verified all personnel are clear of all line of fire zones, the work is finished and a thorough inspection of the equipment and worksite is completed.
- Release of securement or support mechanisms, disengaging of brakes and opening of valves shall be performed only by the Authorized Employee(s).
- Removal of personal lock(s) and/or tag(s) is only to be performed by the Authorized Employee(s) who affixed the lock(s) and/or tag(s).

4.10 Annual Program Review

4.10.1 At least annually (or whenever any incident or serious near miss occurs due to inadequate LOTO) , an independent Qualified Person or Authorized Employee who is not involved in the procedure being assessed shall conduct and document a review and assessment of the energy control program specific to the identified facility. The assessment should include a meeting with Authorized Employees and any other Affected Employees.

4.10.2 The assessment shall include the following elements.

- Where lockout is used, evaluation of the Authorized Employees' understanding of responsibilities under the LOTO program.
- Hold group meetings, attended by the Authorized Employee who is performing the inspection and all Qualified People and Authorized Employees who implement the procedure.
- Where tagout is used, evaluation of the Authorized Employees' understanding of responsibilities under the LOTO program and the limitations of the tagout system.
- Review LOTO verification checklists and other documentation to confirm procedure is being correctly followed and documented.
- Observe active application of the LOTO program.
- If deficiencies are noted during the assessment, corrective actions and retraining of Employees, as necessary, shall be performed immediately.
- The inspector shall provide a copy of all assessment documentation to the applicable Manager for review and filing.

4.10.3 These assessments shall, at least, provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These assessments are intended to confirm that the energy control procedures are being properly and consistently implemented.

5.0 Records

5.1 Location or project orientation and training records shall be retained in their respective permanent file repository (project files or SH&E Department files).

6.0 Attachments

- 6.1 [S3AM-325-ATT1](#) [Sample Tags](#)
- 6.2 [S3AM-325-FM1](#) [Lock & Tag Log](#)
- 6.3 [S3AM-325-FM2](#) [LOTO Verification Checklist](#)
- 6.4 [S3AM-325-FM3](#) [Unattended & Emergency Lock Removal](#)
- 6.5 [S3AM-325-FM4](#) [Lockout Tagout Permit](#)

- 6.6 [S3AM-325-FM5](#) [Annual Program & Training Assessment](#)
- 6.7 [S3AM-325-FM6](#) [Equipment-Specific LOTO Procedure Template](#)

Americas

LOTO Verification Checklist

S3NA-325-FM2

Equipment ID (#)/LOTO Location (S) – Device Type and #:	Name:
LOTO Reference Number:	Date:

Lockout Tagout Checklist (LOTO)	Yes	No	Initials
Employee Notification Have all Affected Employees been informed that a LOTO is necessary and the reason for the LOTO?			
Energy Source Identification Has the type and magnitude of all energy sources and the respective method of control been identified?			
Equipment Shutdown Has the machine/equipment been shut down by the normal stopping procedure (depressing the stop button, open switch, close valve, etc.)?			
Applying Energy-Isolating Device Have all energy-isolating devices been applied so that the machine/equipment is isolated from all energy sources?			
Lockout Have all involved Authorized Employees placed their assigned individual lock(s) on all appropriate energy-isolating devices?			
Tagout Have all involved Authorized Employees placed their assigned individual tag(s) the associated lock(s) or, as appropriate, on all applicable energy-isolating devices?			
Energy Dissipation Has all stored/residual energy (such as in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, air, steam, or water pressure) been dissipated/restrained by methods such as grounding, repositioning, blocking, bleeding down, etc?			
Zero Energy State Verification Has verification been made that the equipment is disconnected from all energy sources by first checking that no personnel are exposed, then verifying the isolation of the equipment by operating the push button or other normal operating controls?			
IF SO, THE EQUIPMENT IS NOW LOCKED OUT			
Restoring Equipment to Service	DATE:		
Job Completion Verification Has the machine/equipment and immediate area been checked to make sure that nonessential items have been removed and the machine/equipment components, including guards, are operationally intact?			
Personnel Verification Have all personnel been notified of the intent to remove LOTO, safely positioned or removed from the area and all controls are in neutral?			
Lockout Removal And Equipment Startup Have all involved Authorized Employees removed their assigned individual LOTO devices and the machine reenergized?			
Employee Notification Have all Affected Employees been notified that the LOTO is complete and that the machine/equipment is ready for use?			

NOTES:

Americas

Unattended & Emergency Lock Removal

S3NA-325-FM3

This form shall be completed any time an unattended lock must be removed or for removal of a lock in an emergency situation. For this form, an emergency is defined as an event that may cause injury, fire, explosion, over exposure, or other hazards to the general public, the environment, or personnel.

☐ **Unattended Lock**☐ **Emergency Lock Removal**

1. NAME of Authorized Employee whose LOTO is to be removed:		
2. METHOD(s) used to contact Authorized Employee whose LOTO is to be removed (include detail such as number of attempts, times, by whom, messages left, etc.):		
<input type="checkbox"/> Contact Efforts Successful Prior to Removal <input type="checkbox"/> Contact Efforts Unsuccessful Prior to Removal		
3. LOCATION of LOTO:		
4. REQUIRED CONTACTS: Contact the following AECOM personnel to locate and notify all Affected Employees:		
Contact Name 1:		
Office Phone #	Home Phone #	Cell #
Contact Name 2:		
Office Phone #	Home Phone #	Cell #
Contact Name 3:		
Office Phone #	Home Phone #	Cell #
5. NOTIFICATION: An AECOM representative has been contacted: <input type="checkbox"/> Yes <input type="checkbox"/> No Notification verified by: _____ (print) _____ (sign) OR, the special conditions for not contacting AECOM are as follows:		
6. WALK DOWN: A walk-down of the equipment/system has been performed to ensure that all personnel are removed from hazardous locations: <input type="checkbox"/> Yes <input type="checkbox"/> No Walk-down verified by: _____ (print) _____ (sign)		

	Print Name	Signature	Date
Project / Location Manager			
SH&E Manager			
AFTER COMPLETION OF THESE STEPS, THE LOCK AND TAG MAY BE REMOVED This form must be provided to the AECOM Project / Location Management Team (Manager and SH&E Manager) so the Authorized Employee whose lock was removed (if not previously notified) and any Affected Employees off shift are notified prior to the Employees' next shift of the LOTO removal.			
Notification verified by: _____ (print) _____ (sign)			

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Lockout Tagout Permit

S3NA-325-FM4

Equipment/System to be Isolated: _____

Building: _____ Floor: _____ Column: _____

Other Location: _____

Purpose of Isolation: _____

Type of Isolation: _____

Authorized Employee: _____ Date: _____

Special Instructions: _____

Lockout Tag Out Performed: _____

Tag No.	Device ID	Bldg/Floor/Col.	Installed By	Removed By

Verification System Is Safe for Specified Work to Start

Authorized Employee: _____ Date: _____ Time: _____

Accountability**Accepts Protection**

Requesting Authority: _____ Date: _____ Time: _____

Accountability**Release Protection**

Requesting Authority: _____ Date: _____ Time: _____

Lockout/Tag Out Removal Authorization

Authorized Employee: _____ Date: _____ Time: _____

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Annual Program & Training Assessment

S3NA-325-PR1

Date of Inspection:			
Site/Program:			
Project/Location:			
Lockout Tagout Assessor:			
Lockout Tagout Authorized Employees Interviewed:			
NAME	ID	NAME	ID
1.		6.	
2.		7.	
3.		8.	
4.		9.	
5.		10.	

TRAINING	Yes	No
1. Have Authorized Employees and Qualified Persons had required LOTO training?	<input type="checkbox"/>	<input type="checkbox"/>
2. Are Affected Employees appropriately trained on LOTO and are they being notified before starting LOTO activities?	<input type="checkbox"/>	<input type="checkbox"/>
3. Have employees been re-trained when job assignments, machines, equipment or processes have changed?	<input type="checkbox"/>	<input type="checkbox"/>
4. Do Qualified People, Authorized Employees and Affected Employees understand the LOTO program and their individual responsibilities?	<input type="checkbox"/>	<input type="checkbox"/>
<u>Comments:</u>		
EQUIPMENT	Yes	No
5. Are lockout locks, tags, and the appropriate lockout devices available to physically isolate hazardous energy?	<input type="checkbox"/>	<input type="checkbox"/>
6. Are lockout locks and tags individually identifiable and locks keyed?	<input type="checkbox"/>	<input type="checkbox"/>
7. Are all locks used in the LOTO program marked in such a way so as to distinguish the locks from locks used for any other purpose, and are these locks only used for lockout tag out?	<input type="checkbox"/>	<input type="checkbox"/>
8. Does the tag used with the lock identify the worker servicing the machine or equipment?	<input type="checkbox"/>	<input type="checkbox"/>
<u>Comments:</u>		

PROCEDURES	Yes	No
9. Have equipment & machine-specific LOTO procedures been written as required given the type of machine or equipment?	<input type="checkbox"/>	<input type="checkbox"/>
10. Have the LOTO procedures been updated for machines, equipment, or processes that have changed?	<input type="checkbox"/>	<input type="checkbox"/>
11. Do employees know the LOTO procedures and where they are located?	<input type="checkbox"/>	<input type="checkbox"/>
Comments:		
PERFORMANCE	Yes	No
12. Can Authorized Employees identify all hazardous energy sources and associated hazards for each of the equipment or machines to be locked out?	<input type="checkbox"/>	<input type="checkbox"/>
13. Do Authorized Employees follow the proper LOTO procedures for de-energizing the equipment or machine to a zero-energy state?	<input type="checkbox"/>	<input type="checkbox"/>
14. Does the Authorized Employee demonstrate the proper steps for the placement, removal and transfer of LOTO devices?	<input type="checkbox"/>	<input type="checkbox"/>
15. Do Authorized Employees use the proper methods for the "try attempt" to verify the equipment was de-energized?	<input type="checkbox"/>	<input type="checkbox"/>
16. Before releasing the machine or equipment from LOTO, does the Authorized Employee; inspect the machine to ensure it is intact, ensure that all employees are safely positioned, notify Affected Employees and all other employees in the area?	<input type="checkbox"/>	<input type="checkbox"/>
17. Are Affected Employees and all other employees in the area notified that the LOTO devices have been removed?	<input type="checkbox"/>	<input type="checkbox"/>
18. Is all required LOTO documentation completed (e.g. Lock and Tag Log, LOTO Verification Checklist, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>
19. If you answered "No" to any of the questions 11-18, has the employee been re-trained?	<input type="checkbox"/>	<input type="checkbox"/>
Comments:		
DEFICIENCIES AND CORRECTIVE ACTIONS:		
1.		
2.		
3.		
4.		

Approved:

Lockout Tagout Assessor

Date

Approved:

Project/Location SH&E /Manager

Date

Approved:

Project/Location Manager

Date

Americas

Equipment-Specific LOTO Procedure Template

S3NA-325-FM6

PROCEDURE REFERENCE NUMBER:

EQUIPMENT:														
EQUIPMENT NO:	LOCATION:													
PURPOSE <p>This seven-step procedure establishes the minimum requirements for the lockout of energy isolating devices whenever servicing or maintenance is done on facility equipment. This procedure will be used to ensure that the equipment is stopped, isolated from all potentially hazardous energy sources and locked out before employees perform any maintenance where the unexpected energization or startup of the equipment or release of energy could cause injury.</p>														
COMPLIANCE WITH THIS PROCEDURE <p>All Employees are required to comply with the restrictions and limitations imposed on them during the use of this procedure. The Qualified Person (if applicable) and Authorized Employees are required to perform the lockout in accordance with this procedure. Other Employees, upon observing a piece of equipment which is locked and/or tagged out, will not attempt to start, energize, or use said equipment.</p>														
SEQUENCE OF LOCKOUT/TAGOUT														
1. All Affected Employees will be notified that the equipment must be shut down and locked out to perform servicing or maintenance. Specific Instructions:														
2. The Qualified Person (if applicable) or Authorized Employee will identify the type and magnitude of the energy that the equipment utilizes, will understand the hazards of the energy, and will know the methods to control the energy. ENERGY <table border="0"> <tr> <td>_____ Electrical (44V)</td> <td>_____ Natural Gas</td> <td>_____ Spring</td> </tr> <tr> <td>_____ Hydraulic</td> <td>_____ Gravity</td> <td>_____ Steam</td> </tr> <tr> <td>_____ Chemical</td> <td>_____ Pneumatic</td> <td>_____ Thermal</td> </tr> <tr> <td>_____ Other</td> <td></td> <td></td> </tr> </table>			_____ Electrical (44V)	_____ Natural Gas	_____ Spring	_____ Hydraulic	_____ Gravity	_____ Steam	_____ Chemical	_____ Pneumatic	_____ Thermal	_____ Other		
_____ Electrical (44V)	_____ Natural Gas	_____ Spring												
_____ Hydraulic	_____ Gravity	_____ Steam												
_____ Chemical	_____ Pneumatic	_____ Thermal												
_____ Other														
3. Shut down operating equipment by the normal stopping procedures (depress stop button, open switch, close valve, etc.). Specific Instructions:														
4. Apply the energy isolating device(s) so that the equipment is isolated from the energy sources(s). Specific Instructions:														
5. Authorized Employee(s) lockout and tagout the energy isolating devices(s) with assigned individual locks and tags. Lockout Equipment Needed:														

6.	Dissipate any stored or residual energy (such as that in capacitors, springs, hydraulic systems, and air, steam, or water pressure, etc.) by methods such as grounding, repositioning, blocking, bleeding down, etc. Specific Instructions:
7.	Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment by operating the normal operating control(s) or by testing to make certain the equipment will not operate. CAUTION: Return controls to "OFF" after verification. THE EQUIPMENT SHOULD NOW BE LOCKED OUT AT ZERO ENERGY STATE. Specific Instructions:
METHODS OF VERIFICATION	
Verification should be determined via start-up attempts, visual observations and testing. For electrical verification, place local on/off switch to ON position and verify equipment will not operate. Return the switch to OFF position and commence work.	
DEVELOPED BY: <div style="text-align: right; margin-top: 20px;">(print) _____</div>	DATE: _____ <div style="text-align: right; margin-top: 20px;">(sign) _____</div>

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Sample Tags

S3NA-325-ATT2



This energy source has
been LOCKED OUT

Only the individual who
signed the reverse side
may remove this lock/tag
Remarks: _____



**LOCKED
OUT**
DO NOT OPERATE

This lock/tag may
only be removed by:

Name _____

Dept _____

Expected Completion _____

Powder-Actuated Tools

S3AM-327-PR1

1.0 Purpose and Scope

- 1.1 This procedure establishes requirements addressing the potential hazards associated with the use of powder-actuated tools and identifies appropriate controls for their use.
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **High-velocity tool** – A powder-actuated tool that fires a charge at an average test velocity of greater than 492 feet per second (*these types are illegal in the United States*).
- 2.2 **Low-velocity tool** – A powder-actuated tool that fires a charge at an average test velocity of less than 492 feet per second.
- 2.3 **Powder-actuated tool** – A nail gun (often called a “Hilti gun” or “Ramset gun” after two of the companies who manufacture the tools) used in the construction and manufacturing industries to join materials to hard substrates like steel and concrete. Also known as “direct fastening,” this technology relies on a controlled explosion created by igniting a small chemical propellant charge, similar to the process that activates a firearm.
- 2.4 **Qualified operator** – An employee who has been trained in the proper handling and use of the powder-actuated tool, met applicable certification / licensing requirements, and has been authorized by AECOM to operate the powder-actuated tool.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-208-PR1 Personal Protective Equipment
- 3.3 S3AM-305-PR1 Hand & Power Tools

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager

- Verify that all employees using powder-actuated tools are properly trained.
- Verify the training and credentials of powder-actuated tool users.
- Verify that the tool user carries a special certification card where required by a State, Province, Territory, or other local governing body.
- Prevent unauthorized access to areas where powder-actuated tools are in use.
- Confirm powder-actuated tools are inspected as per *S3AM-327-FM1 Powder-Actuated Tool Pre-Operational Inspection* form prior to use and tools found with defects red tagged and removed from service.
- Verify that all powder-actuated tools and cartridges are securely stored when not in use to prevent unauthorized and unlawful use.

4.1.2 Safety, Health and Environment (SH&E) Manager

- Conduct/support powder-actuated tool hazard assessments/evaluations and recommend appropriate precautions to involved and affected AECOM employees.
- Provide technical guidance and support as to this procedure.
- Assist with inspections and investigations as necessary.

4.1.3 Employee

- Only operate a powder-actuated tool if authorized as a qualified operator.
- Operate the powder-actuated tool in accordance with the manufacturer's instructions.
- Inspect powder-actuated tools prior to use utilizing the *S3AM-327-FM1 Powder-Actuated Tool Pre-Operational Inspection* form or equivalent.
- Notify the Manager of a tool malfunction, defect, or improper cartridge discharge.
- Properly secure all tools and cartridges when they are not in use.
- Nonessential Employees are to remain outside the work areas where powder-actuated tools are in use.

4.2 Training

- All employees authorized as qualified operators of powder-actuated tools shall be properly trained and will maintain copies of training credentials and/or licenses as required.
 - Employees shall demonstrate knowledge on the use of the powder-actuated tool.
 - Employees shall be trained in this procedure.
 - Refer to *S3AM-003-PR1 SH&E Training*.
 - Qualified operators shall meet any licensing or certification requirements of the applicable jurisdiction. The State of California requires a specific certification card in order to use a powder-actuated tool.
- Only persons trained and authorized by the tool manufacturer or by an authorized representative of the tool manufacturer will be qualified to instruct and qualify operators for the manufacturer's powder-actuated tools.
- All authorized instructors will have in their possession a valid authorized instructor's card issued and signed by an authorized representative of the manufacturer.

4.3 Operation and use of powder-actuated tools are as follows:

- Only qualified operators will operate tools. The qualified operator will carry, when operating such tools, a card as proof of training and qualifications.
- Only powder-actuated tools meeting the design requirements of ANSI A10.3-1995 *Safety Requirements for Powder-Actuated Fastening Systems* or CSA Z166-M85 *Safety Code for Powder-Actuated Tools* may be used.
- Powder-actuated tools can be dangerous when not used in accordance with the manufacturer's information and instruction. Hazards such as tool kick-back or fastener ricochet can result from improper operation.
- Tools will be operated in strict accordance with the manufacturer's instructions. Always confirm the powder load is correct for application and tool in use.
- Unauthorized personnel will be cleared from the line of fire when the tool is in use.
- Neither loaded nor empty tools will be pointed at any person.
- Qualified operators of powder-actuated tools shall wear eye/face protection and hearing protection when the tool is in use. Refer to *S3AM208-PR1 Personal Protective Equipment*.

- Employees shall be notified when a powder-actuated tool is to be used in the area through a verbal announcement such as "Firing!" and shall be given adequate time to clear the line of fire.
- Each day, prior to use, the qualified operator will inspect the tool, using the *S3AM-327-FM1 Powder-Actuated Tool Pre-operational Inspection* form to determine that it is in proper working order. Any tool found not to be in proper working condition will be immediately removed from service and tagged as "DEFECTIVE/REMOVE FROM SERVICE." It will not be used until it has been properly repaired in accordance with the manufacturer's instructions.
- The proper shield, fixture, adaptor, or accessory suited for the application, as recommended and supplied by the manufacturer, will be used.
- Center Punch Test Procedure. This is a very simple, quick test that can be made to determine base material suitability. Use a fastener as a punch on the actual base material for the following:
 - If the material shows a clear fastener point impression and the fastener point is not blunted, proceed with the first test fastening.
 - If fastener point is blunted, material is too hard.
 - If material cracks or shatters, material is too brittle.
 - If fastener sinks into material with an average hammer blow, the material is too soft.
- No tool will be loaded unless it is being prepared for immediate use. If the work is interrupted after loading, the tool will be unloaded at once. Even if equipped with keepers, restrainers, or captive stud capabilities, the tool will not be pointed at any person.
- The tool will always be held perpendicular to the work surface when fastening into any material, except for specific applications recommended by the tool manufacturer.
- Hands and feet will be kept clear of the open barrel end.
- Should a misfire occur, the tool will be held against the work surface for a full 30 seconds, and then follow the manufacturer's instructions for subsequent actions.
- Control of the charges by supervision at the work site is required to prevent mishap.
- The issuing employee will have a current list of qualified operators and numbers of powder-actuated tools.
- Tools will never be left unattended when not securely stored.

4.4 Limitations of Use

- Powder-actuated tools will not be used where flammable gases, vapors, dusts, or explosives are present.
- The fastener will not be driven into an existing hole unless a guide supplied by the manufacturer is used to confirm proper alignment.
- Fasteners will not be fired into very hard or brittle materials, some of which include cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, and hollow tile. Fasteners will not be driven into soft or thin materials that could be completely penetrated by the fastener unless there is a backing that would prevent penetration through the other side.
- Fasteners will not be driven closer than 1/2 inches (13 millimeters) from the edge of steel or 3 inches (76 millimeters) from the edge of masonry materials, except for specific applications recommended by the manufacturer.
- Fasteners will not be driven into concrete unless material thickness is at least three times the fastener shank penetration.
- Fasteners will not be driven into any spalled area.

4.5 Storage and Handling

- Always make sure that you point the tool away from your body and others during loading or handling.
- When not in use, a powder actuated tool shall be unloaded and the tool and powder loads shall be securely stored in a dry metal container and be accessible only to qualified operators and authorized employees (lock and key).
 - Powder loads of different powder levels and types shall be kept in different compartments or containers.
 - The container should be painted red with white letters, and only authorized employees will be permitted access to it. The container should be labeled, "Powder Actuated Tool" on the outside and "For Use by Authorized Personnel Only" and "Keep Locked When Not in Use" on the inside of the container.
- Always unload a powder-actuated tool before disassembling, assembling, replacing the barrel, or cleaning.
- The manufacturer's instruction and service manual, a powder load and fastener chart, repair tools, cleaning tools, and a tool inspection record will be stored in the tool container, refer to *S3AM-305-PR1 Hand & Power Tools*.
- Fired or spent cartridges can be recycled.
- Unfired powder loads will not be thrown into trash containers or carelessly discarded.
 - If a round misfires or does not fire at all when actuated in the tool, remove the defective cartridge and try again with a new one.
 - The defective unspent cartridges should be stored in bucket of water or similar type of container. After being placed in water, unspent cartridges should be treated the same as spent cartridges.
 - Unfired powder loads will be returned to the original place of issuance.

5.0 Records

5.1 None

6.0 Attachments

6.1 [S3AM-327-FM1 Powder-Actuated Tool Pre-Operational Inspection](#)

Americas

Powder-Actuated Tool Pre-Operational Inspection

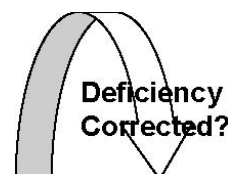
Name :

Project #:

Date S/N:

Person Conducting Inspection:

Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO**, this deficiency must be corrected prior to use of the specific tool.

**YES**

☐ Operators of powder-actuated tools trained and carry certification / license to operate the specific tool?

☐ Tool tested prior to day's operation to confirm that safety devices are in proper working condition? *(This method of testing shall be conducted as per manufacturer recommendation)*

☐ Proper PPE available and used?

☐ All employees cleared of line of fire?

☐ Fastening surfaces are not very hard or brittle materials?

☐ Driving into easily penetrated materials avoided, unless such materials are backed by a substance that will prevent the fastener from passing completely through?

☐ New fastening area chosen if first fastening rejected?

☐ Tools not used when explosive or flammable atmospheres are present?

☐ All guards in place on tool?

☐ Does the powder-actuated tool meet the requirements set forth in ANSI A10.3- 1995, *Safety Requirements for Powder-Actuated Fastening Systems* or CSA Z166-M85 *Safety Code for Powder-Actuated Tools*?

COMMENTS:

Railroad Safety

S3AM-329-PR1

1.0 Purpose and Scope

- 1.1 This procedure establishes the minimum requirements for employees working within the railway's right-of-way or rail yard (commuter or freight).
- 1.2 This procedure is intended to protect personnel and equipment from being struck by a railroad train or other moving railroad equipment.
- 1.3 This procedure is not applicable to railway systems operated and maintained by AECOM.
- 1.4 This procedure applies to all AECOM Americas-based employees and operations.

2.0 Terms and Definitions

- 2.1 **Employee-In-Charge** – Railway-qualified employee in charge of on-track safety within the right-of-way.
- 2.2 **Flagman** – An employee designated by the railway (typically a railway employee) to direct or restrict the movement of trains past a point on a track to provide on-track safety for roadway workers, while engaged solely in performing that function.
- 2.3 **Fouling a Track** – The placement of an individual or an item of equipment in such proximity to a track that the individual or equipment could be struck by a moving train or on-track equipment, or in any case is within 4 feet (1.2 meters) of the field side of the near running rail. Maintain 25 feet (7.6 meters) of clearance from the centerline of the track unless work activities require personnel to enter this area, and specific instructions from the railroad employee-in-charge have been provided. Specific railways may define fouling distances differently; therefore, it is up to the project team to understand the railway's requirements.
- 2.4 **Maintenance-of-Way** – The maintenance of railway rights-of-way, including track.
- 2.5 **On-track Safety** – A state of freedom from the danger of being struck by a moving railroad train or other railroad equipment, provided by operating and safety rules that govern track occupancy by personnel, trains and on-track equipment.
- 2.6 **Railway Right-of-Way** – For AECOM's purposes, the railway right-of-way will be defined as extending 25 feet (7.6 meters) from the centerline of the tracks (both sides of the tracks). Specific railways may define their right-of-way differently; therefore, it is up to the Project Manager to clearly define the projects' requirements.
- 2.7 **Roadway Worker** – Any employee of a railway, or of a contractor to a railway, whose duties include inspection, construction, maintenance or repair of railway track, bridges, roadway, signal and communication systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near the track or with the potential of fouling a track.
- 2.8 **Watchman/Lookout** – An employee (typically a railway employee) who has been annually trained and qualified to provide warning to roadway workers of approaching trains or on-track equipment. Watchmen/lookouts will be properly equipped to provide visual and auditory warning such as whistle, air horn, white disk, red flag, lantern, or fuse. A watchman/lookout's sole duty is to look out for approaching trains/on-track equipment and provide at least fifteen seconds advanced warning to employees before arrival of trains/on-track equipment.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-019-PR1 Substance Abuse Prevention

- 3.3 S3AM-302-PR1 Electrical Safety
- 3.4 S3AM-314-PR1 Working Alone
- 3.5 S3AM-322-PR1 Overhead Lines
- 3.6 S3AM-331-PR1 Underground Utilities

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 Managers

- Defining the Railway Right-of-Way requirements and communicating those requirements to the affected project staff.
- Verifying the railway client's specific safety requirements and procedures to follow, and communicating those requirements to the affected project staff.
- Verifying that an appropriate safety planning document (e.g. Health and Safety Plan, Task Hazard Analysis) was written for the planned scope of work and communicated to the affected staff.
- Identifying the need for Roadway Worker Protection [On-Track] awareness training, railway-specific orientation training, e-RailSafe credentialing (or other client-required training), and substance abuse screening requirements, and other railway-specific requirements applicable to defined scope of work, refer to *S3AM-003-PR1 SH&E Training*
- Confirm that employees designated to perform any railway work activities are properly trained to perform their job-specific assignments including Maintenance-of-Way or other client-required training.
- Developing and submitting a drug and alcohol program to the applicable railway for all AECOM employees serving in a "covered service" function (e.g., signaler, locomotive operator, etc.), as defined by governing legislation. Refer to *S3AM-019-PR1 Substance Abuse Prevention*.
- Coordinating with the railroad project representative during the project for information about current operational conditions and communicating those to the affected project staff.

4.1.2 Employee-In Charge

- Adhering to the safety requirements defined in the approved safety planning document as well as the applicable railway-specific safety requirements.
- Donning the personal protective equipment identified in the approved safety planning document.
- Verifying that the tracks are not fouled without Employee-In Charge's approval.
- Confirming the removal of all staff and equipment from the right-of-way prior to a train passing by.
- Implementing the project's Emergency Response Plan in the event of a site emergency.

4.1.3 Employee

- Adhering to the safety requirements defined in the approved safety planning document as well as the applicable railway-specific safety requirements.
- Not fouling the tracks without the approval of the Employee-In-Charge or Flagman.
- Donning the personal protective equipment identified in the approved safety planning document.
- Following the directions given by the Employee-In-Charge, Flagman, or Watchman/Lookout.
- Evacuating the area when directed in accordance with the project's Emergency Response Plan.

4.1.4 Safety, Health and Environment (SH&E) Manager

- Assisting project management with railway hazard assessments, recommending appropriate controls, and interpreting railway-specific safety requirements.
- Assisting project management with the identification of railway-specific training services.
- Reviewing the project's safety plan.
- Providing guidance to project management regarding the development and implementation of a Drug and Alcohol Program, refer to *S3AM-019-PR1 Substance Abuse Prevention*.
- Assisting project management to deal with an employee who was found to be in violation of the Drug and Alcohol Program.

4.2 General Requirements

- 4.2.1 Site Safety Briefing (e.g., tailgate / toolbox meeting) shall be held before beginning work each day and whenever work conditions change. Along with the job hazard topics related to the task(s) to be performed, the following shall also be included:
- Designation of the employee-in-charge;
 - Method of on-track safety;
 - Limits of authority (time, milepost to milepost);
 - Tracks that may be fouled, and
 - Control of movements on adjacent tracks.
- 4.2.2 AECOM will not foul the tracks without approval from the railway's Employee-In-Charge or Flagman.
- 4.2.3 Adhere to all railway-specific safety requirements when on railway property and/or within the defined right-of way.
- 4.2.4 Follow all directions issued by the railway's Employee-In-Charge, Flagman, or Watchman/Lookout.
- 4.2.5 Check that all communication equipment is functional prior to starting work.
- 4.2.6 Never position body or body parts in the path of line of fire or potential pinch points.
- Do not cross between rail cars and maintain a 50 feet (15.2 meters) clearance from the front or end of a train. Note: this distance may vary between railway organizations. Have a position of safety identified prior to entering the railway's right-of-way.
- 4.2.7 As applicable to the scope of work, follow all railway-specific Maintenance-of-Way operating rules.
- 4.2.8 If unsure about any aspect of the on-track safety program, employees shall stay in a safe location and seek further clarification from the Project Manager or Employee-in-charge before approaching the tracks.
- 4.2.9 Report hazardous conditions, safety issues and security conditions immediately to the employee-in-charge.

4.3 Precautions When Working on or near Live Rail

- 4.3.1 Look in each direction prior to entering upon or standing close to the tracks.
- 4.3.2 Do not work within 25 feet (7.6 meters) of any active track without authorization.
- 4.3.3 Workers shall be positioned facing the train's directional approach.
- 4.3.4 Stop at all railroad crossings.
- 4.3.5 Cross tracks at designated railroad crossings, unless project work requires crossing elsewhere.
- 4.3.6 Do not cross tracks immediately after a rail vehicle or train has passed; wait until all adjacent tracks can be observed for a safe distance in both directions.

- 4.3.7 Do not sit, walk, step, or stand on the rail unless it is necessary to perform the work. When required to work in or along track areas, walk on or cross the tracks on the cross-ties and ballast only.
- 4.3.8 Do not cross tracks at turnout switch points.
- 4.3.9 Ensure that all crew members know where to go when it is necessary to clear the track for rail vehicle or train movement. All crew members must clear the track on the same side.
- 4.3.10 Do not spend unnecessary time fouling a track. Whenever possible, perform all preparations necessary for the work activity in a safe location.
- 4.3.11 When working at a stationary location, always ensure that a railroad flagger is present to warn oncoming trains, rail vehicles, etc., to slow down or stop.
- 4.3.12 Do not use personal radios, headphones, cell phones, etc.
- 4.3.13 Employees shall not wear any unnecessary personal protective equipment or clothing that could obstruct vision or impair hearing.
- 4.3.14 Do not climb underneath railcars or take other shortcuts.
- 4.3.15 When required by the work, face railroad equipment when getting on or off.
- 4.3.16 Do not get on or off moving equipment.
- 4.3.17 Employees shall not make any movement towards an oncoming train that may lead the train engineer to think the Employee is about to foul the track.
- 4.3.18 Employees shall not assume a scheduled train has already passed the employee's location; the train may be late.
- 4.3.19 Do not leave unattended equipment within 25 feet (7.6 meters) of the track centreline, fouling the track, or within 250 feet (76 meters) of a crossing.
- 4.3.20 Move equipment and personnel from the right-of-way prior to a train passing by.
- 4.3.21 Keep all vehicles at least 15 feet (4.6 meters) from the track.
- 4.3.22 Keep all air hoses, electrical cords, etc. clear of the track. Any equipment that must be placed on the track shall run under the rail.
- 4.3.23 Some rails are conductors of electrical current and an integral part of the railroad operating system. Do not lay devices that could shunt current across rails.
- 4.3.24 In catenary systems, all overhead wires must be considered energized at all times. Watch for high loads; cranes and lifts may interfere with catenary systems. Clearances from energized overhead lines and grounding requirements must follow regulatory or railroad standards, whichever is more stringent, when working in the proximity to overhead power lines.
- 4.3.25 Regard loose or broken impedance bond connections in the tracks as energized (live) and report immediately to the employee-in-charge.
- 4.3.26 Do not touch dangling wires or foreign objects hanging from wires, nor attempt to move them by any means. Immediately report their location to the employee in charge and, if possible, leave someone to keep others out of the area and away from the wires until they can be removed by a qualified person.
- 4.3.27 Work on energized circuits shall be done in accordance with *S3AM-302-PR1 Electrical Safety*.
- 4.3.28 Use fuse pullers for removing and replacing fuses.
- 4.3.29 Some railways have a third rail that sits above and on the edge of the cross ties, typically energized at several hundred volts DC. Never sit or step on the third rail or its cover board. Keep tools and person clear of the third rail. AECOM personnel shall receive safety training on the third rail system

and follow the governing safety procedures. Only qualified railway employees may apply and remove third rail protective blankets.

4.4 Lone Worker

- 4.4.1 Employees shall not work alone on or near (within 25 feet / 6.7 meters) an active railroad unless approved by a SH&E Manager and the railroad (if applicable).

4.5 Utilities

- 4.5.1 Many utilities (both overhead and underground) use railroad rights-of-way. Excavation or drilling in these rights-of-way requires assurance of utility clearance before digging. Prior to beginning work, refer to *S3AM-322-PR1 Overhead Lines* and/or *S3AM-331-PR1 Underground Utilities*.
- 4.5.2 Railroad control and signal cables may be buried or above ground. Special care must be taken not to disturb or damage these cables due to their critical safety function.
- 4.5.3 Clearances from energized utilities are specified by the local railroad. When the voltage is unknown, keep cranes, overhead equipment and personnel a minimum distance of 45 feet (13.8 meters).

5.0 Records

- 5.1 All training records shall be maintained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

None

Underground Utilities

S3AM-331-PR1

1.0 Purpose and Scope

- 1.1 Provides procedures designed to help prevent injuries to personnel working on the location and pedestrians, property damage, and adverse environmental impact as a result of potential hazards associated with encountering underground utilities, subsurface installations, and potential overhead hazards.
- 1.2 Provides the minimum requirements to be followed for underground work (e.g., excavations, drilling, boring, and probing work) to ensure that underground installations, and subsurface structures, are identified properly before work commences.
- 1.3 This procedure applies to all Americas-based employees and operations.
- 1.4 The Manager is responsible for meeting all the requirements in this procedure.
- 1.5 AECOM's clients may have specific procedures which shall be followed to identify and map utility and subsurface structures on their properties or facilities. Provided the client's procedures meet or exceed those of AECOM, approval shall be obtained from the Manager and the SH&E Manager to follow the client's procedures.

2.0 Terms and Definitions

- 2.1 **Underground Utilities** – All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.
- 2.2 **Clearance** – includes the following:
 - The positive locating of underground utilities or subsurface installations in or near the work area.
 - A signed statement by an appropriate representative attesting to the location of underground utilities and/or the positive de-energizing (including lockout) and testing of electrical utilities.
- 2.3 **Ground Disturbance (GD)** – Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.
- 2.4 **Hand Clearance Zone** – The area on either side of the locate marks of a utility that shall be maintained in order to expose the utility through the use of non-destructive ground disturbance techniques acceptable to the owner of the buried utility. Visual exposure is required before mechanical excavation equipment may be used.
- 2.5 **Intrusive Activities** – Examples: Excavation of soil borings, installations of monitoring wells, installation of soil gas sampling probes, excavation of test pits/trenches or other man-made cuts, cavity, trench or depression in an earth surface formed by earth removal.
- 2.6 **Non-Destructive Ground Disturbance Technique** – A safe and acceptable excavation method that is used to visually expose an underground utility without causing damage. Non-destructive ground disturbance techniques may include, but are not limited to:
 - Hand digging.
 - Use of non-conductive tools.
 - Hydro-vacuum.
- 2.7 **Subsurface Installation** – Examples: Subterranean tunnels, underground parking garages and other structures beneath the surface.
- 2.8 **Utility Strikes** – Unplanned contact with utilities resulting in damage to the utility or its protective coating.

3.0 References

- 3.1 S3AM-003-PR1 SH&E Training
- 3.2 S3AM-303-PR1 Excavation
- 3.3 S3AM-321-PR1 Drilling, Boring & Direct-Push Probing

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager

- Administer this procedure and the development of the SH&E Plan.
- Confirm the appropriate equipment and materials are available to conduct the underground utility and/or subsurface installation clearance.
- Confirm all employees involved and affected by the task review the SH&E Plan and Task Hazard Assessment (THA) prior to work commencing
- Authorize work to proceed using the *S3AM-331-FM2 Underground Utility & Subsurface Installation Clearance Checklist*.
- Confirm that employees conducting underground utilities and subsurface clearance processes possess all required training, registrations or certifications.
- Provide authorization (with the concurrence of the Site Supervisor and SH&E Manager) for work to resume if interrupted due to unexpected conditions or events.

4.1.2 Safety, Health & Environment (SH&E) Manager

- Assist AECOM management as needed by providing guidance and clarification as to issues that may arise.
- Review the SH&E Plan to confirm compliance with jurisdictional regulations. Provide technical guidance as needed when a variance is pursued related to this procedure.

4.1.3 Employees

- Maintain training as appropriate to the work to be completed (e.g. ground disturbance, lockout tagout, equipment operation, etc.). Refer to *S3AM-003-PR1 SH&E Training*.
- Review the SH&E Plan and Task Hazard Assessment (THA) prior to work commencing.
- As appropriate to the anticipated or encountered hazards and as addressed in the applicable planning documentation, utilize appropriate personal protective equipment (PPE) and applicable training, practices and operating procedures.
- Immediately notify the Manager of any unanticipated conditions or events. If assigned equipment, perform appropriate inspections and confirmations of maintenance and/or repairs.

4.2 Training

4.2.1 All on-site employees involved with the underground utility and subsurface identification and associated clearance process shall be trained, at a minimum, in these procedures.

4.2.2 Employees shall complete all required training associated with their tasks in accordance with the SH&E Training Matrix and any training assessments developed at the business group.

- Refer to *S3AM-003-PR1 SH&E Training*.
- This training may include, but is not limited to, Excavation / Trenching (Ground Disturbance), HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.

4.2.3 As applicable, employees shall receive client-required training.

4.3 Planning

4.3.1 Health and Safety Plan – At a minimum, a SH&E Plan and task hazard assessments (THAs) shall be prepared prior to any underground utilities and subsurface installations clearance activities.

- The SH&E Plan will address any required environmental monitoring including gas monitoring, dust, noise, metals, radiation or other monitoring as may be appropriate for site conditions.
- Employees shall comply with all SH&E Plan requirements.
- The location specific emergency response plan shall be in place, contain procedures applicable to the potential emergencies presented by the operations, and be reviewed with all personnel potentially affected.

4.3.2 *S3AM-331-ATT2 Underground Utilities & Subsurface Installation Clearance Flow Chart* provides a summary of the key requirements addressed in this procedure.

4.3.3 Underground utilities and subsurface installations shall be investigated as being present, including the following, but not limited to:

- Steam, gas and electric.
- Sewer and water.
- Subterranean tunnels.
- Fibre optics (note: routine geophysical surveys will not identify fibre optic cables).
- Traffic control cables.

4.3.4 Location of underground utilities and subsurface installations will be confirmed by cross-referencing available information:

- Maps, as-built drawings and issued for construction (IFC) drawings.
- Plot plans, permits, crossing/encroachment agreements.
- One-Call information, locator and provided surveys.
- Private utility information, locator and provided surveys (e.g. ground penetrating radar (GPR), electromagnetic, etc.).
- Owner supplied documentation.
- Site walks.

4.3.5 As applicable, emergency shut-off locations of utilities shall be verified before work activities commence.

4.3.6 Jurisdictional, land owner, client and utility owner requirements shall be consulted to determine the minimum search zone dimensions and appropriate clearance distances.

4.3.7 As necessary and if possible, adjust locations of excavations or intrusive subsurface work away from subsurface utilities and installations

4.3.8 Prior to any excavation or intrusive subsurface work, the *S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist* shall be completed. The form shall be reviewed and signed by the Manager.

- If the answer to any question in Part 1 of the checklist is “No” or “N/A”, no ground disturbance may take place without review by the Manager, in consultation with SH&E Manager, of the circumstances related to the particular item. The Manager shall initial beside each “No” or “N/A” item to indicate review and authorization.

4.4 Permits, Notifications and Access Agreements

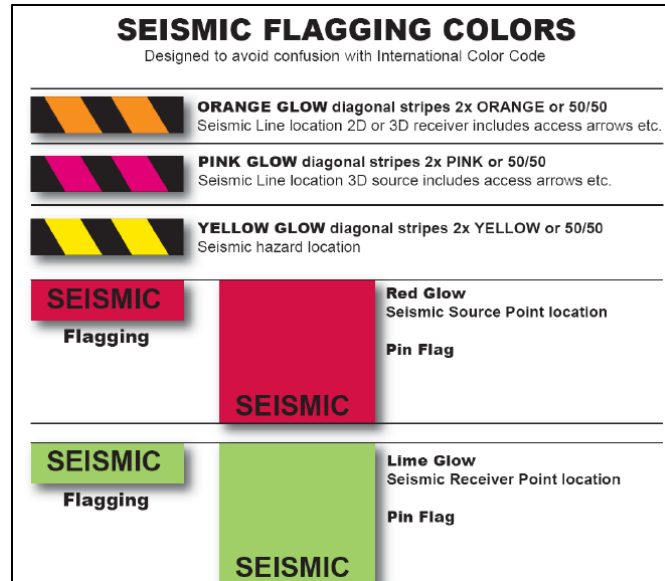
- 4.4.1 Any required notifications shall be provided within the appropriate timeframe to the applicable organization (e.g. owner, utility company, agency, governing body, etc.).
- 4.4.2 All applicable permits (e.g. client, government, working near rail road, etc.) will be identified, obtained, and adhered to.
- 4.4.3 All access agreements will be obtained and adhered to.
- 4.5 Locating Underground Utilities and Subsurface Installations
 - 4.5.1 Utilize the appropriate call/click-before-you-dig provider. Refer to *S3AM-331-ATT1 One-Call System*.
 - 4.5.2 Federal/State/Provincial/Territorial and other “One Call” providers shall be contacted at least two working days and no more than ten working days prior to commencing the ground disturbance. Jurisdictional requirements shall be consulted to verify the appropriate advance notice. (e.g. 24 hours, two full working days, three to ten business days, etc.).
 - 4.5.3 If the location of proposed excavation or intrusive subsurface work cannot be clearly and adequately identified, the route and/or area of the proposed ground disturbance shall be identified using white flags, paint or stakes prior to the arrival of the locator. Consult jurisdictional requirements as white-lining may be a mandatory requirement on all ground disturbances.
 - 4.5.4 One Call providers shall appropriately identify and mark the subsurface utilities or installations, or otherwise provide written notification they do not have any facilities near the proposed subsurface/intrusive locations.
 - 4.5.5 Confirm all circuits were on during subsurface checks if the checks were for identifying energized lines (e.g. circuits on timers or light sensing switches).
 - 4.5.6 Areas that have a high density of sub-surface facilities may require a secondary locate by another independent locator to verify locations identified by the first locator.
- 4.6 Private Utility Locating
 - 4.6.1 One Call services may not be available in various non-urban locations. Private utility locating companies shall be utilized to identify and located any underground utilities or subsurface installations.
 - 4.6.2 Be aware urban areas (e.g. city or town) may have subsurface installations (e.g. underground garages) and utilities (e.g. public water, sewer, and gas pipelines) that are not covered by one-call systems.
 - These subsurface installations and utilities require additional investigation and diligence beyond the one-call system.
 - Additional investigation and diligence beyond the one-call system is also recommended for non-urban areas.
 - 4.6.3 In urban areas, private utility locating companies shall be called to identify and locate, through geophysical surveys and other means, the presence of private utilities installed by the property owner (e.g. irrigation systems) and to verify the presence of public utilities on the properties.
 - Hand clearing is required in urban areas.
 - 4.6.4 Hand clearing is also recommended for non-urban areas and may be required by the given jurisdiction.
 - 4.6.5 Warning tape, pea gravel, sand, non-indigenous material, bentonite, red concrete (indicative of electrical duct banks) and any departure from native soil or backfill may be evidence of the presence of subsurface installations and utilities.
- 4.7 Surface Markings

- 4.7.1 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines from the One-Call System (refer to S3AM-331-ATT1), guidance contained in this procedure or as contract-specified.
- 4.7.2 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.
- 4.7.3 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than 2 inches.
- 4.7.4 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.
- 4.7.5 Locate marks shall be re-verified as per jurisdictional requirements or no later than 14 days after the previous locate was completed, whichever interval is shorter. These locate time intervals shall be maintained for the duration of the ground disturbance.
- If the work is interrupted during the determined lifespan or work does not commence during the applicable lifespan, a new locate shall be performed.
 - Jurisdictional provisions may allow for an extension to the lifespan of the locate marks, however certain conditions may need to be met. (e.g. activities uninterrupted)
 - If locate marks are moved or destroyed the location of the buried facilities shall be re-established.
- 4.8 Uniform Color Coding
- 4.8.1 The colors and corresponding installation type are as follows unless otherwise contract-specified:

AMERICAN PUBLIC WORKS ASSOCIATION – APWA
Color Coding for Marking of Buried Facilities

White	Proposed Ground Disturbance Area
Pink	Temporary Survey Markings
Red	Electric Power Lines, Cables, Conduit and Lighting Cables
Yellow	Gas, Oil, Steam, Petroleum Lines or Gaseous Materials
Orange	Conduit, Cable, Communication, Alarm or Signal Lines
Blue	Potable Water
Green	Sewer, Storm Sewer and Drain Lines
Purple	Reclaimed Water, Irrigation and Slurry Lines (non-potable)

Canadian Association of Geophysical Contractors



4.9 Identification and Mapping of Utility and Subsurface Structures

- 4.9.1 The locations of subsurface utilities and subsurface installations shall be investigated, documented, and shown on a site plan (a scaled site plan shall be used when feasible). Refer to *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist*.
- 4.9.2 Documentation of utility and subsurface installation identification (calling one call, responses from utilities) along with the scaled site plan shall be available on the worksite at all times of intrusive activities.

4.10 Site Walk

- 4.10.1 A site walk shall be conducted by the AECOM Manager and any other appropriate personnel with the objectives of reviewing all planned intrusive activity locations, the locations of subsurface and overhead utilities, overhead obstructions, and the potential for subsurface installations, to determine the appropriate utility clearance activities, and to observe other physical hazards.
 - Walk the area at least 50 feet (15.2 meters) from perimeter of the site to observe physical hazards.
 - Walk the area of at least 50 feet (15.2 meters) radius from each proposed subsurface intrusion location.
 - If possible, particularly at urban and industrial sites, the client/property owner or an individual knowledgeable about the site and site utilities will attend the site walk.
 - Add discovered items/issues to map for use in location confirmation.
- 4.10.2 The Site Walk further supplements the Identification and Mapping of Utility and Subsurface Structures procedure. Site Walks should be repeated as necessary following the Identification and Mapping of Utility and Subsurface Structures as visual verification of the hazards. Examples include:
 - Proposed location(s) does not lie on a line connecting two similar manhole covers (e.g. sanitary sewer or storm drain).
 - Proposed subsurface location(s) has not subsided, been excavated and patched, nor gives the appearance it may be covering a former trench (e.g. linear cracks, sagging curbs, linear re-pavements, etc.).
 - Proposed subsurface location(s) does not lie on a line with any water, gas, electrical meters, utility cleanouts, or other utility boxes in the surrounding areas.

4.11 Proposed Subsurface Investigation Locations

- 4.11.1 All proposed subsurface locations will be reviewed in comparison to subsurface and overhead utilities and subsurface installations and adjustments made as necessary.
- 4.11.2 Minimum set back distances from subsurface and overhead utilities and subsurface installations will be established including 5 feet (1.5 meters) from any subsurface utility, 7 feet (2.1 meters) from the pad surrounding any underground storage tanks, and 10 feet (3 meters) from any overhead energized electrical line (or further depending on line voltage). These set back distances are a minimum; government regulations and utility requirements may dictate a greater set back distance.

4.12 Utility Clearance Investigation Location Confirmation

- 4.12.1 As applicable, all client on-site safety procedures shall be understood and adhered to.
- 4.12.2 Hand exposure or non-destructive ground disturbance techniques to expose an underground utility or subsurface installation are necessary to accurately determine size, location and alignment prior to mechanical excavation or intrusive subsurface work in the vicinity of that utility or installation.
- 4.12.3 Non-destructive ground disturbance techniques shall be acceptable to the owner of the buried utility (i.e. hydro-vacuum temperature or pressure).
- 4.12.4 Hydro-vacuum or air-knife require proper grounding equipment at sites where the subsurface may contain flammable gases, liquids, or vapors
- 4.12.5 Jurisdictional, land owner, client and utility owner requirements shall be consulted to determine the distance of the hand exposure zone, and what requirements, when met, may allow mechanical excavation within these zones.
- 4.12.6 At a minimum, all underground utilities and subsurface installations within a 5 feet (1.5 meter) radius of the work site shall be identified and physically located (seen) before use of mechanical excavation equipment is permitted. Jurisdictional, client, land owner and utility owner requirements shall be consulted as the required hand exposure radius may be larger.
- 4.12.7 In urban areas, proposed subsurface locations will be hand cleared to 5 feet (1.5 meters) (soil borings and wells) or 12 inches (30 centimeters) (soil gas sampling probes) using non-mechanical methods.
 - In non-urban areas, hand clearing should be conducted if possible and shall be conducted as required by the given jurisdiction.
 - Hand clearance should be extended if locations of deep utilities and structures are not known.
 - Hand exposure or non-destructive ground disturbance techniques should extend a minimum of 24 inches (60 centimeters) below the intended ground disturbance depth to minimize the hazard of mechanical equipment contact with any utility or installation.
- 4.12.8 Mechanical equipment and attachment dimensions shall be considered when establishing the zone in which all underground utilities and subsurface installations are physically located (seen) prior to the use of that equipment. The radius may require expanding to maintain safe distances when using large equipment.

4.13 Utility Strikes

- 4.13.1 Utility strikes shall be reported in accordance with *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*.
- 4.13.2 All damaged utilities shall be repaired by a qualified and/or licensed professional.

5.0 Records

- 5.1 Retain completed *S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist* and documents related the clearance process (e.g. Utility Owner communication, etc.) in the site or project files.

- 5.2 Documentation of employee training completed shall be retained in accordance with S3AM-003-PR1 SH&E Training.

6.0 Attachments

- 6.1 [S3AM-331-ATT1](#) [One-Call System](#)
- 6.2 [S3AM-331-ATT2](#) [Underground Utilities & Subsurface Installation Flow Chart](#)
- 6.3 [S3AM-331-FM1](#) [Underground Utility & Subsurface Installation Clearance Checklist](#)

Americas

Underground Utilities & Subsurface Installation Clearance Checklist

S3NA-331-FM1

Location:	Project #:	Date & Time:
Manager:	Contractor (if applicable):	Weather:
Client:	Inspector:	
Notes:		

Part 1

Part 1 and Part 2 shall be completed prior to any intrusive subsurface work. DO NOT DISTURB GROUND if a "No" or "N/A" answer to any of the Part 1 questions has not been initialed as authorized by the AECOM Manager.

Any variance from these procedures requires approval of the Vice President of the applicable business group.

	Yes	No	N/A
I. Permits and Access Agreements			
1. Have all appropriate permits and agreements been identified and obtained (e.g. client, drilling, encroachment, working near railroads, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have all client requirements been identified and obtained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. If working off-site is (are) site access agreement(s) executed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
II. General Health and Safety			
1. Has a Health and Safety Plan (HASP) been prepared for AECOM employees?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Do on-site personnel have required-level PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Do on-site personnel have required-level of training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is appropriate monitoring equipment as specified in HASP/THAs available at each clearance location?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Has the field screening equipment been calibrated as required by the HASP?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Are calibration gases available at the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
III. Identification and Mapping of Utility and Subsurface Structures			
1. Is a Site Plan showing proposed subsurface locations and utility locations attached to this check list?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Have above/below ground utilities & subsurface installations been investigated (Part 2 of this form)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have all Federal/State/Provincial/Territorial and other "One Call" providers marked their facilities or otherwise notified they do not have any facilities near the proposed subsurface/intrusive locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Have Federal/State/Provincial/Territorial or other "One Call" providers identified what utilities and underground structures are <u>not</u> included in their provider system (e.g. underground structures)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. As noted in the exception at the bottom of Section VI of this checklist, has a utility locating contractor performed geophysical and/or other surveys of the proposed subsurface/intrusive locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Visual verification that each of the proposed locations does not lie on a line connecting two similar manhole covers (e.g. sanitary sewer or storm drain)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Visual verification that the ground in the vicinity of each of the proposed subsurface locations has not subsided, been excavated and patched, give the appearance it may be covering a former trench (e.g. linear cracks, sagging curbs, linear re-pavements, etc.) and does not lie on a line with any water, gas, electrical meters, utility cleanouts, or other utility boxes in the surrounding areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Part 1 and Part 2 shall be completed prior to any intrusive subsurface work. DO NOT DISTURB GROUND if a "No" or "N/A" answer to any of the Part 1 questions has not been initialed as authorized by the AECOM Manager.

Any variance from these procedures requires approval of the Vice President of the applicable business group.

	Yes	No	N/A
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IV. Site Walk

1. Has a site walk been performed that includes the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. Reviewing all planned intrusive locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Adjusting locations away from subsurface utilities and installations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Determining the appropriate utility clearance activities for each location?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Determining the presence and location of overhead utilities and obstructions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Walk around perimeter of the site to observe physical hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Includes 50 feet (15.2 meters) from perimeter of the site to observe physical hazards and 50 feet (15.2 meters) radius from each proposed subsurface location?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

V. Proposed Subsurface Investigation Locations*

1. Are all of the proposed subsurface locations at least 5 feet (1.5 meters) from any identified subsurface utility?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Are all of the proposed subsurface locations at least 7 feet (2.1 meters) from the pad surrounding any underground storage tanks (USTs) shown on the Site Plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Are all of the proposed subsurface locations at least 5 feet (1.5 meters) from any subsurface utilities shown on the Public Right-of-Way street improvements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* These set back distances are a minimum; government regulations and utility requirements may dictate a greater set back distance.

VI. Utility Clearance Investigation Location Confirmation*

1. Have subsurface locations been hand cleared as follows? Hand clearance should be extended if locations of deep utilities and structures are not known. In non-urban areas hand clearing should be conducted if possible and according to local requirements.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
a. For soil borings/monitoring wells; excavated to a minimum of 5 feet (1.5 meters) below ground surface using non-mechanical methods?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. For soil gas sampling; excavated to 2 foot (0.6 meter) below grade or below the bottom of a concrete floor prior to the installation of soil gas sample probe points?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

* Exceptions to requirements of the utility clearance process, as permitted by the applicable jurisdiction, include the following:

- Sites where extensive utility mapping (e.g. geophysical survey) has been completed and/or where extensive activities have already been performed.
- Locations where facility layout is well documented and understood.
- Sites or portions of large sites where utilities are known not to exist currently or to not have ever existed throughout the life of the facility, property or site.

Comments:

Documentation supplied by one-call or private utility and installation locators, including email or written field confirmation / maps of mark-out requests and status shall accompany this form. If this form is supporting multiple ground disturbance activities, a copy of this completed form should be provided to each activity.

Part 2

Public Utility Locate (OneCall)			Prior Locate Ticket #	
Date Called:		Called By:		Valid Until:
Ticket Number:		Area Requested To Be Cleared:		
Private Utility Locate			Prior Locate Ticket #	
Company Performing Locate:			Date Completed:	
Area(s) Requested To Be Cleared (including distance around marked locations):				
Method(s) Used (e.g., GPR, EM):				
Confirm Area(s) Cleared:				
OneCall Utilities			Field Observation	
Utility	Notified by	Comments	Marked (mains & services)	
Electric (Red)	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Gas/Petroleum Pipeline (Yellow)	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Sewer/Drainage (Green)	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Water (Blue)	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Communications (Orange)	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Other	<input type="checkbox"/> OneCall <input type="checkbox"/> Other		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Were all circuits on during subsurface checks if the checks were for identifying energized lines (e.g., circuits on timers or light sensing switches)?			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A	
Utilities Not Identified By OneCall (Includes both Public and Private along with Regional and Site Utilities)			Field Observation	
Utility (Colors may vary)	Owner / Contact / Phone #	Notified	Marked	
Communications: (Orange) TV, computer, phone, cell towers, site communication, cameras, security, etc.		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Electricity: (Red) Mains / Supplies / Interior / Exterior (signs, fuel pumps, low voltage security perimeters, gates, property light posts, equipment, substations, etc.)		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Gas: (Yellow) Mains / Supplies / Equipment / Pipelines (Natural, Process, Oil, Crude, Refined (Gas, Diesel, Jet), etc.)		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Steam: (Yellow)		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Structures: Possible horizontally installed facilities, vaults, basements, tunnels, sub-grade structures, foundations, overhead obstructions, etc.		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
UST Systems (Tanks / piping / electric)		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Sewer: (Green) Sanitary, storm, combined, septic, drainage (parking, buildings, fields), irrigation		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
Water: (Blue) Process, Plant, potable, well, cooling, return/makeup, fire, sprinkler, landscape irrigation, reclaim (Purple) other		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	
Other: Abandoned lines, invisible dog fences, shopping cart perimeter monitoring, traffic lights		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Above	

Manager:

Print

Sign

Date

Americas

One-Call System

S3NA-331-ATT1

1.0 What Is It?

- 1.1 One-call systems are established across the Americas to provide one telephone number for excavating contractors and the general public to call for notification of their intent to use equipment for excavating, tunneling, demolition, or any other similar work. This one-call system provides the participating members an opportunity to identify and locate their underground facilities.
- 1.2 As described on their web site (<http://www.call811.com>), Common Ground Alliance (CGA) was “created specifically to work with all industry stakeholders in an effort to prevent damage to underground utility infrastructure and ensure public safety and environmental protection.” CGA also services as an organization to continuously update best practices a month the growing underground industry. The CGA web site provides current one-call information for all states and provinces.

2.0 Why Is It Needed?

- 2.1 Damage to underground facilities increased considerably following the building boom of the 1950s, 1960s, and early 1970s when the trend was to go underground with utilities. Thousands of miles of underground facilities are vulnerable to excavating machines such as backhoes, and the resulting damage can interrupt utility service and threaten life, health, and property.

3.0 How to Get It

- 3.1 In the United States 811 is the Federally-mandated national “Call Before Your Dig” number that connects directly to the local one-call center. Each state has different rules and regulations governing digging, some stricter than others. The CGA web site provides current contact information to find state-specific information as well as links to submit an online digging request where available. Canadian one-call numbers vary by jurisdiction. One-call services are not available in Canada’s Atlantic provinces (New Brunswick, Newfoundland, Nova Scotia) or in the three Northern Territories (Nunavut, Northwest Territories, Yukon).

4.0 Disclaimer

- 4.1 The purpose of this directory is to illustrate the extent of one-call service available. Some jurisdictions have a list of “Tier 1” subscriber utilities notified by 811, and a “Tier 2” list that the excavator/contractor is responsible for contacting directly. Users shall verify information is current including the extent and limit of service from local sources.

Province/State		One-Call Agency	Number
Canada		www.clickbeforeyoudig.com	
Alberta	Alberta One Call	www.albertaonecall.com	1.800.242.3447
British Columbia	BC One Call	www.bconeall.bc.ca	1.800.474.6886
Manitoba	Click Before You Dig	www.clickbeforeyoudigmb.com	Various – see website
Ontario	Ontario One Call	www.on1call.com	1.800.400.2255
Québec	Info Excavation	www.info-ex.com	1.800.663.9228
Saskatchewan	Sask 1 st Call	www.sask1stcall.com	1.866.828.4888

United States		www.call811.com	811
Alabama	Alabama 811		1.800.292.8525
Alaska	Alaska Digline, Inc.		1.800.478.3121
Arizona	Arizona 811		1.800.782.5348
Arkansas	Arkansas One Call		1.800.482.8998
California	(North & Central) USA North 811		1.800.227.2600
	(South) Dig Alert		1.800.227.2600
Colorado	Colorado 811		1.800.922.1987
Connecticut	Call Before You Dig		1.800.922.4455
Delaware	Miss Utility of Delmarva		1.800.282.8555
District of Columbia	District One Call		1.202.265.7177
Florida	Sunshine 811		1.800.432.4770
Georgia	Georgia 811		1.800.282.7411
Hawaii	Hawaii One Call		1.866.423.7287
Idaho	Dig Line, Inc.		1.800.342.1585
	(Bonner/Boundary) Pass Word		1.800.626.4950
	(Kootenai County) Pass Word		1.800.428.4950
	(Shoshone-Benewah) Pass Word		1.800.398.3285
Illinois	(Chicago) Digger -Chicago Utility Alert Network		312.744.7000
	(Outside of Chicago) JULIE		1.800.892.0123
Indiana	Indiana 811		1.800.382.5544
Iowa	Iowa One Call		1.800.292.8989
Kansas	Kansas 811		1.800.344.7233
Kentucky	Kentucky 811		1.800.752.6007
Louisiana	LA One Call		1.800.272.3020
Maine	Dig Safe		1.888.344.7233
Maryland	(West of Chesapeake Bay) Miss Utility of Maryland		1.800.257.7777
	(East of Chesapeake Bay) Miss Utility of Delmarva		1.800.282.8555
Massachusetts	Dig Safe System, Inc.		1.888.344.7233
Michigan	Miss Dig		1.800.482.7171
Minnesota	Gopher State One Call		1.800.252.1166
Mississippi	Mississippi 811		1.800.227.6477

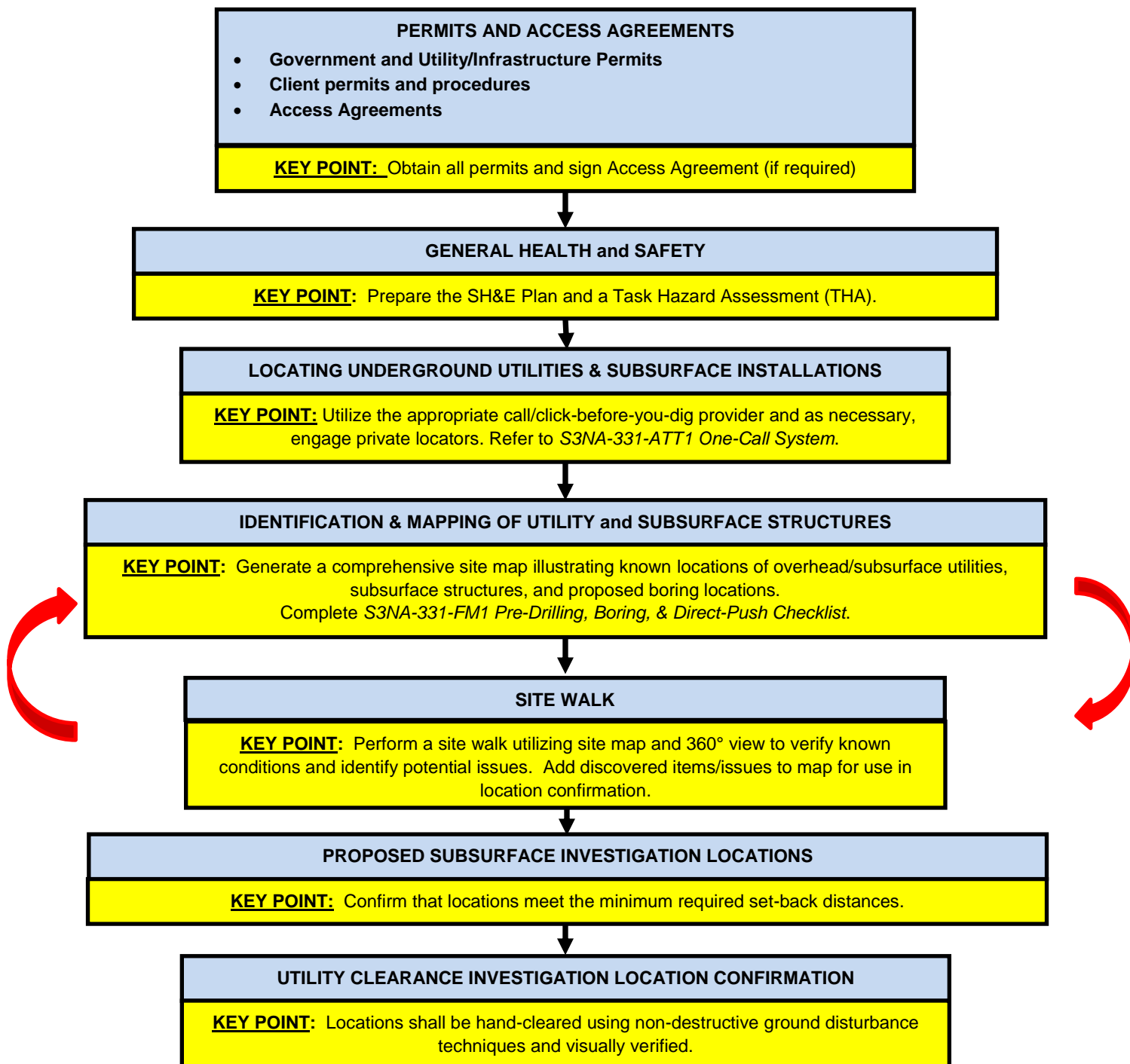
Missouri	Missouri One Call System	1.800.344.7483
Montana	Montana 811	1.800.424.5555
	(Flathead and Lincoln Counties) Montana One Call Center	1.800.551.8344
Nebraska	Nebraska 811	1.800.331.5666
Nevada	USA North 811	1.800.227.2600
New Hampshire	Dig Safe System, Inc.	1.888.344.7233
New Jersey	New Jersey One Call	1.800.272.1000
New Mexico	New Mexico 811	1.800.321.2537
New York	(North of 5 Boroughs) Dig Safely New York	1.800.962.7962
	(5 Boroughs and Long Island) New York 811, Inc.	1.800.272.4480
North Carolina	North Carolina 811	1.800.632.4949
North Dakota	North Dakota One Call	1.800.795.0555
Ohio	Ohio Utilities Protection Service	1.800.362.2764
Oklahoma	Call Okie	1.800.522.6543
Oregon	Oregon Utilities Notification Center	1.800.332.2344
Pennsylvania	Pennsylvania One Call System, Inc.	1.800.242.1776
Puerto Rico	Puerto Rico Public Service Commission 811	
Rhode Island	Dig Safe System, Inc.	1.888.344.7233
South Carolina	South Carolina 811	1.888.721.7877
South Dakota	South Dakota One Call	1.800.781.7474
Tennessee	Tennessee 811	1.800.351.1111
Texas	Texas 811	1.800.545.6005
	Lone Star 811	1.800.669.8344
Utah	Blue Stakes of Utah	1.800.662.4111
Vermont	Dig Safe System, Inc.	1.888.344.7233
Virginia	Virginia 811	1.800.552.7001
Washington	Utility Notification Center	1.800.424.5555
West Virginia	WV 811	1.800.245.4848
Wisconsin	Diggers Hotline	1.800.242.8511
Wyoming	One-Call Of Wyoming	1.800.849.2476

Americas

Underground Utilities & Subsurface Installation Clearance Flow Chart

S3NA-331-PR1

Before Any Underground Utilities and Subsurface Installation Clearance



Hot Work

1.0 Purpose and Scope

- 1.1 Establishes the minimum requirements for welding, cutting, and other hot work activities. Other AECOM activities may also trigger the need for a Hot Work Permit and procedure depending upon the associated hazards (e.g. internal combustion engine or electrical equipment in flammable atmospheres).
- 1.2 This procedure applies to all AECOM Americas-based employees and operations.
- 1.3 AECOM's clients may have hot work related procedures. Provided the client's procedures meet or exceed those of AECOM, the client procedures may be used in place of AECOM's procedure. AECOM employees shall be familiar with client requirements for welding, cutting and other hot work activities and coordinate such activities with the client representative.

2.0 Terms and Definitions

- 2.1 **Authorized Air Monitor** – Worker(s) who have been designated to monitor the presence of flammable gas in the area where hot work is planned using appropriate air-monitoring equipment.
- 2.2 **Class I Location – Gases or Vapors** – Hazardous area in which flammable gases or vapors may be present in sufficient quantities to be explosive or ignitable. Local regulations should be reviewed to ensure all conditions are met prior to entering work zone.
- 2.3 **Class II Location – Combustible Dust** – Hazardous area in which combustible dust under normal operating conditions is present at concentrations sufficient to produce explosive or ignitable mixtures. Local regulations should be reviewed to ensure all conditions are met prior to entering work zone.
- 2.4 **Class III Location – Fibers** – Hazardous area in which fibers or materials capable of producing combustible fibers are present in concentrations sufficient to produce ignitable mixtures. Local regulations should be reviewed to ensure all conditions are met prior to entering work zone.
- 2.5 **Combustible Material** – Any material that may ignite when introduced to an ignition source (e.g., wood, paper, cardboard and plastic).
- 2.6 **Designated Area** – A specific area designed or approved for hot work, such as a maintenance shop, a detached outside location that is of non-combustible or fire-resistive construction, or an outdoor location (many greenfield construction sites) essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. A Hot Work Permit is not required in a Designated Area.
- 2.7 **Fire Watch** – Worker(s) designated to monitoring hot work and the surrounding area for incipient fires and changing conditions.
- 2.8 **Hot Work** – A work activity that by the nature of the operation (e.g., grinding, burning, thermo cutting/welding, brazing, etc.) creates an open source of ignition (primary source of ignition or secondary source of ignition) or that could produce temperatures high enough to cause the ignition of flammable gases and combustible materials.
- 2.9 **Hot Work Control Areas** – Fire-hazardous areas such as cable-spreading rooms, cable trays, conveyor galleries, rubber-lined piping equipment and structures, potentially explosive atmospheres, and similar hazardous hot work areas identified by project safety personnel.
- 2.10 **Hot Work Operator** – Worker(s) who will handle the hot work equipment and conduct the hot work processes.
- 2.11 **Hot Work Permit** – Document issued prior to the start of hot work, which is used to verify the presence of appropriate fire prevention and protection measures.

- 2.12 **Intrinsically Safe** – A form of protection based on the restriction of electrical energy within the system, equipment or tool to a level below that which may cause ignition by either sparking or heating effects. Most electronic communication devices, flashlights, cameras and power tools are not rated as intrinsically safe.
- 2.13 **Lower Explosive Limit (LEL)** – The minimum concentration of a particular flammable or combustible gas or vapor necessary to support its combustion in air. The safety factor for hot work is 10 percent of the LEL as measured using a calibrated combustible gas detector. Note: At 10 percent of the LEL, the atmosphere may be considered immediately dangerous to life and health (IDLH). In some locations, the safety factor for hot work is 5 percent of the LEL.
- 2.14 **Primary Source Ignition (PSI) Hot Work** – Any work with equipment and tools that use high-energy sources (open flames, electric arcs or incandescent spark) that may ignite flammable or combustible atmospheres, solid materials or liquids when used in a normal manner. PSI hot work is often referred to as 'naked flame' hot work. Examples of PSI hot work include, but are not limited to, the following:
- Welding and burning,
 - Grinding, and
 - Torch cutting and soldering.
- 2.15 **Secondary Source Ignition (SSI) Hot Work** – Any work with equipment and tools that may create low-energy sparks and ignite a flammable or combustible atmosphere when used in a normal manner or due to errors or malfunction. SSI hot work is also referred to as 'spark potential' hot work. Examples of SSI hot work include, but are not limited to, the following:
- Sandblasting;
 - Using electrical or electronic equipment that is not intrinsically safe or explosion proof (e.g., most electronic communication devices, flashlight, etc.);
 - Using spark-ignition engines (including vehicles) in a Class I area (e.g., vehicle entry into a tank dike);
 - Using a rotating steel brush;
 - Electrical isolation testing; and
 - Producing a friction spark, typically from a rusty surface.
- 2.16 **Sources of ignition** – In locations where flammable vapors may be present, precautions shall be taken to prevent ignition by eliminating or controlling ignition sources. These may include open flames, lightning, smoking, cutting and welding, hot surfaces, frictional heat, sparks (static, electrical, and mechanical), spontaneous ignition, chemical and physical-chemical reactions, and radiant heat.

3.0 References

- 3.1 Q2-312-PR1 Monitoring and Measuring Equipment Procedure
- 3.2 S3AM-002-PR1 Stop Work Authority
- 3.3 S3AM-003-PR1 SH&E Training
- 3.4 S3AM-011-PR1 Fire Protection
- 3.5 S3AM-012-PR1 First Aid
- 3.6 S3AM-202-PR1 Competent Person Designation
- 3.7 S3AM-208-PR1 Personal Protective Equipment
- 3.8 S3AM-301-PR1 Confined Spaces
- 3.9 S3AM-325-PR1 Lockout Tagout

3.10 S3AM-123-PR1 Respiratory Protection

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager/Supervisor**

- Administer this procedure and the development of the project SH&E Plan.
- Confirm AECOM Employees receive the specified level of protection as to project welding, cutting and burning activities.
- Confirm a Hot Work Permit is issued and has been signed by all parties prior to starting hot work and all control measures are maintained during hot work.
- Confirm compliance with this procedure during all hot work operations.
- Confirm all Employees performing hot work and in the vicinity of hot work are appropriately trained to the applicable tasks and associated hazards.

4.1.2 **Hot Work Operator**

- Maintain appropriate training to the task(s) to be undertaken. Know and apply applicable company and regulatory policies and procedures related to hot work operations.
- Participate in the inspection of welding and burning equipment and work areas.
- Participate in the completion of and sign the Hot Work Permit to acknowledge his or her understanding of the conditions documented on the permit.
- Comply with the conditions of the issued Hot Work Permit.
- Safely handle hot work equipment and processes.
- Stop hot work operations immediately if unsafe conditions develop and notify the Manager or Supervisor immediately for evaluation and appropriate action.

4.1.3 **Authorized Air Monitor**

- Responsible for operating air-monitoring equipment to monitor the presence of flammable gas in the area where hot work is planned.
- Participate in the completion of and sign the Hot Work Permit to acknowledge his or her understanding of the conditions documented on the permit. Perform the following duties:
 - Verify that the air monitoring device to be used is calibrated according to the manufacturer's instructions and that calibration information is documented in Section B – Atmospheric Monitoring of *S3AM-332-FM1 Hot Work Permit* or equivalent.
 - Perform initial air monitoring of the hot work area for the presence of flammable gas.
 - Perform continuous air monitoring for the presence of flammable gas between the hot work and potential vapor sources.
 - Verify that a LEL Mitigation Plan is developed and documented in Section C – LEL Mitigation Plan of *S3AM-332-FM1 Hot Work Permit* or equivalent if initial or continuous air monitoring detects the presence of flammable gas (LEL is greater than 0 percent).
 - Verify that the LEL Mitigation Plan is implemented and flammability is controlled to less than 10 percent (or 5% in certain jurisdictions) of the LEL before allowing hot work to proceed.
 - Stop all hot work if any air monitoring reading is greater than 10 percent (or 5% in certain jurisdictions) of the LEL.

- The Authorized Air Monitor may also be the Fire Watch, if a Fire Watch is required per Section D – Fire Watch of *S3AM-332-FM1 Hot Work Permit*.
- The Authorized Air Monitor shall not be a Hot Work Operator during PSI hot work but may be a Hot Work Operator during SSI Class 1 hot work.
- NOTE: Refer to Air Monitoring (Class 1 Areas) of this procedure for additional information regarding the Authorized Air Monitor and air monitoring requirements.

4.1.4 Fire Watch

- Responsible for monitoring hot work and the surrounding area for incipient fires and changing conditions.
- Participate in the completion of and sign the Hot Work Permit to acknowledge his or her understanding of the conditions documented on the permit.
- The Fire Watch may also be the Authorized Air Monitor. Refer to Section D – Fire Watch of *S3AM-332-FM1 Hot Work Permit*
- Perform no duties other than those required of the Fire Watch, and if applicable, the Authorized Air Monitor.
- Perform no other duties apart from fire watch duties (and Authorized Air Monitor if applicable), including, but not limited to the following duties:
 - Understand the location, nature and hazards of the hot work to be performed.
 - Survey the area to verify that the necessary fire protection equipment is in place and ready for use and be trained in its use.
 - Confirm that safe conditions are maintained during hot work operations.
 - Remain within communication range of the person(s) performing the hot work and maintain a line of sight with the hot work.
 - Do not leave the area for any reason without a replacement or stopping the hot work.
 - Watch for fires in all areas exposed to hot work and communicate to Hot Work Operators to cease all hot work if a fire occurs.
 - Try to extinguish a fire only when the fire is obviously within the capacity of the equipment available.
 - Sound the alarm (e.g., air horn) and implement evacuation procedures immediately if determined a fire is not within the capacity of the available extinguishing equipment.
 - In the absence of fire or evacuation, remain in the hot work area at least 30 minutes after the hot work has ceased to detect and extinguish possible smoldering fires.
- The Fire Watch shall not be a Hot Work Operator and shall have no other duties other than Fire Watch, and if applicable, the Authorized Air Monitor, during the hot work activities and for a period of at least 30 minutes afterwards.

4.2 General Requirements

- 4.2.1 As applicable, alternative methods to hot work shall be employed when fire-hazardous areas (e.g., cable-spreading rooms, cable trays, conveyor galleries, rubber-lined piping equipment and structures, etc.), potentially explosive atmospheres, and similar hazardous areas may be encountered.
- 4.2.2 At a minimum, a SH&E Plan and a task hazard assessment (THA) shall be prepared prior to any hot work activities.
- The SH&E Plan will identify the hot work activities and address any required environmental

monitoring including gas monitoring, dust, noise, metals, radiation or other monitoring as may be appropriate for site conditions.

- The SH&E Plan will provide the measures required to eliminate or otherwise control the hazards associated with the hot work.
- The Hot Work Permit Applicability decision flow chart contained in the procedure shall be used to identify air monitor, fire watch and hot work permit requirements.
- All SH&E Plan requirements will be followed by AECOM personnel.
- The location specific emergency response plan shall be in place, contain procedures applicable to the potential emergencies presented by the operations, and be reviewed with all personnel potentially affected. Refer to *S3AM-010-PR1 Emergency Response Planning*.

4.2.3 Before any hot work is performed, and as part of developing the SH&E Plan, the area shall be evaluated for flammables or combustibles by the Supervisor responsible for authorizing hot work. Examples may include, but are not limited to:

- Identifying flooring materials.
- Determining if any materials such as paper, straw or wood shavings are within 50 feet (15.24 meters) of the proposed hot work.
- Verifying the contents of any containers or tanks within 50 feet (15.24 meters) of the proposed hot work.
- Testing to determine if flammable atmospheres exist in the proposed hot work area.
- Testing the atmosphere in vessels that may be welded or cut to verify adequate cleaning or purging.
- Assessing the dryness of grass or trees in the hot work area and vicinity.

4.2.4 Where hot work permits are used, all hot work activities shall be controlled and isolated from flammables and combustibles.

4.2.5 Performing hot work in classified and non-classified areas may be considered a hazardous activity, and a Hot Work Permit may be required. Refer to *S3AM-332-FM1 Hot Work Permit*.

4.2.6 The Hot Work Permit has five purposes:

- To serve as written permission to do the work;
- To provide a minimum safety checklist;
- To show the steps necessary to provide a safe job site for conducting hot work;
- To alert operating personnel to the work in progress; and
- To provide a record of safety steps taken for contract work.

4.2.7 The client may also have requirements for whether a hot work permit is required.

4.2.8 Individuals, who have the technical and procedural competencies as defined by AECOM as well as their roles within the Hot Work activity, shall provide input to the permit as necessary to address all hazards and permit conditions related to the hot work.

4.2.9 Engineering controls shall be implemented to control hot work hazards to the extent feasible.

- Non-intrinsically safe equipment is prohibited from all locations that may contain a flammable or combustible atmosphere.
- Positive air shut-off valves on internal combustion engines may be required to prevent ignition of flammable or combustible atmospheres.
- When possible, objects to be welded, cut, or heated shall be moved to a designated safe

location. If this is not possible, all movable combustibles in the workspace shall be taken away to a safe place.

- If the object to be welded, cut, or heated cannot be moved and all combustibles cannot be removed (e.g., equipment, walls, floors, etc.), positive means shall be taken to confine the heat, sparks, and slag to protect the immovable combustibles.
- No welding, cutting, or heating shall be done where application of flammable paint, presence of other flammable compounds, or heavy dust concentrations create a possible hazard.
- Wherever there are openings or cracks in the flooring that cannot be closed, precautions shall be taken so no sparks or slag will drop through the floor. The same precautions shall be taken in the presence of cracks or holes in walls, open doorways, and open or broken windows.
- Provide metal buckets for disposal of electrode stubs.
- When feasible, ventilation shall be in place to control atmospheric hazards.

4.2.10 Identify the type of metal to be worked on and protective coatings that have been applied. Where coatings are flammable or toxic, the coating shall be stripped a minimum of four inches (10 centimeters) from the areas of heat application.

- Before welding, cutting, or heating is commenced on any surface covered by a preservative coating whose flammability is not known, a test shall be made by a competent person to determine its flammability. Refer to *S3AM-202-PR1 Competent Person*.

4.2.11 Position welding screens or shields to protect workers and passers-by from welding arc rays.

4.2.12 All hot work equipment shall be used only for operations for which it is approved and as recommended by the manufacturer and maintained in good repair in accordance with manufacturer's specifications.

4.2.13 All personnel involved in a hot work operation have the authority and responsibility to stop any work that they consider to be unsafe. Refer to *S3AM-002-PR1 Stop Work Authority*.

4.2.14 Employees assigned to operate or maintain oxygen/fuel-gas supply equipment and resistance welding equipment will be thoroughly instructed in the safe use and maintenance of such equipment by a qualified person.

4.2.15 If other Employees are required to work in the vicinity of hot work operations, they shall be protected, given the required PPE, and be notified of the work and all safety procedures prior to starting the hot work (e.g., screens, signs identifying workpieces that are hot, barricades and restricted entry to hot work area, etc.).

4.2.16 Exposure to welding operations can result in eye damage, burns, or respiratory illness. If an incident occurs, seek medical attention and report it to the Manager or Supervisor. Refer to *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*.

4.2.17 Training shall be provided as to the use of Hot Work Permits to all associated Employees in accordance with *S3AM-003-PR1 SH&E Training*.

4.3 Training

4.3.1 Employees shall be trained and, as applicable, certified in accordance with anticipated tasks (e.g. Welding, Air Monitor, Fire Watch, etc.), associated hazards, and jurisdictional requirements (e.g., Mexico - annual training to safety procedures of the welding and cutting program). Refer to *S3AM-003-PR1 SH&E Training*.

4.3.2 Training shall be provided as to the use of Hot Work Permits to all associated Employees in accordance with *S3AM-003-PR1 SH&E Training*.

4.4 Personal Protective Equipment

4.4.1 Selection and use of personal protective equipment shall comply with *S3AM-208-PR1 Personal Protective Equipment*.

- Contact lenses should not be worn if there is a potential exposure to chemicals that can irritate the eye.

4.4.2 Eye and Face Protection

- ANSI/CSA-approved welding helmets and hand shields shall be used during all arc welding/cutting operations, excluding submerged arc welding. ANSI/CSA-approved cutting / welding goggles shall also be worn during arc welding/cutting operations. The goggles or glasses may be either clear or colored glass, depending on the type of exposure in welding operations.
- If required to observe the welding operation, use an ANSI/CSA-approved welder's helmet fitted with a filter shade that is suitable for the type of welding that is being performed.
- If required to observe the chipping and grinding operation, use ANSI/CSA-approved impact rated safety goggles or safety glasses with both UVA and UVB radiation protection along with an ANSI/CSA-approved impact rated face shield or welder's helmet.
- ANSI/CSA-approved safety goggles or other ANSI/CSA-approved eye/face protection shall be used during light work gas welding operations, torch brazing, or inspection.
- Hot Work Operators and attendants on resistance welding or brazing equipment shall use ANSI/CSA-approved face shields or goggles, depending on the particular job.

4.4.3 Protective Clothing

- All welders shall wear flameproof gauntlet gloves.
- Welders shall wear approved fire resistant welding jackets or aprons made of leather, or other suitable material for protection against radiated heat and sparks.
- Fire-resistant clothing (FRC) or, as permitted, clothing made of natural fibers (wool, cotton) is required for welders and others working with the Hot Work Operators. Synthetic materials are prohibited.
- ASTM/CSA-approved steel-toed boots with a minimum of 6 inches (15.24cm) of ankle support.

4.4.4 Respiratory Protective Equipment

- Respiratory protective equipment will be selected, used, and maintained in accordance with *S3AM-123-PR1 Respiratory Protection*.
- Respiratory protective equipment shall be required when feasible engineering controls are insufficient to mitigate the respiratory hazards.
- Respiratory protective equipment may be required when one or more of the following conditions exist:
 - Room size (with special regard to ceiling height) is limited, or welding/cutting work is extensive and ventilation is limited.
 - Several welders are working in the area at the same time.
 - Potentially unsafe atmospheric conditions exist.
 - Hazardous fumes, gases, or dusts of toxic metals, particularly lead, cadmium, chromium, beryllium, and zinc, are present in the base metal or in coatings.

4.5 Non-Permissible Areas

4.5.1 All hot work is prohibited in areas not authorized by facility management and the following areas:

- In sprinkler-equipped buildings where sprinklers are impaired, unless the requirements of NFPA 25 are met (or equivalent local standard);

- In the presence of explosive atmospheres (greater than or equal to 10 percent of the LEL); or
- In the presence of unclean or improperly prepared tanks, vessels or other containers and equipment that have previously contained flammable or combustible materials when their contents may be exposed to an ignition source.

4.6 Hot Work Permit

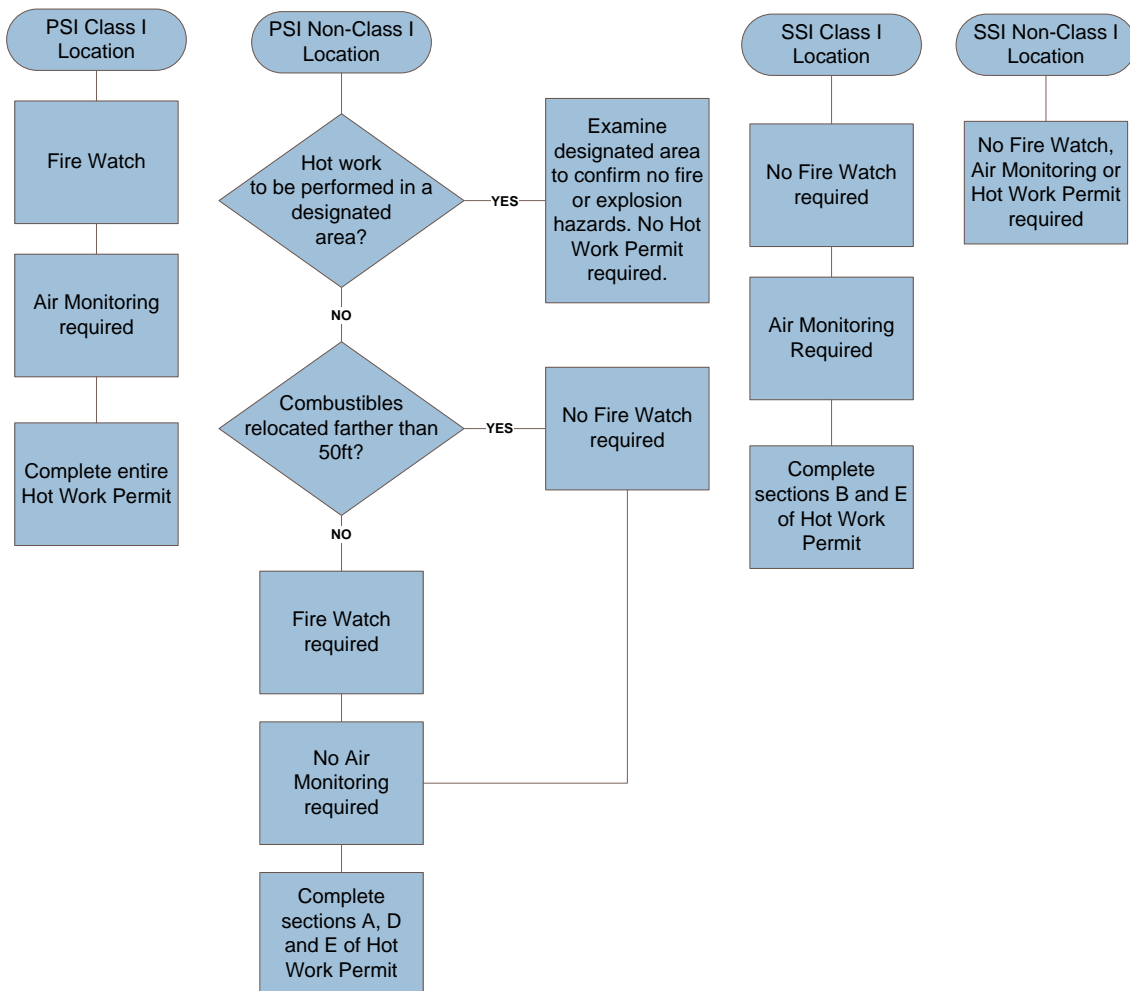
4.6.1 A Hot Work Permit is required and shall be prepared before any PSI hot work (other than in a designated area) or any SSI Class 1 Location hot work is performed. Any volatile contaminants (surface or subsurface) on sites shall be evaluated to determine if the definition of Class 1 is met.

4.6.2 A Hot Work Permit is not required for SSI non-Class 1 Location hot work.

4.6.3 A Hot Work Permit is valid for no more than one work shift.

- If hot work is suspended during a shift, the permit shall be revalidated before further hot work can continue.
- Revalidation involves inspecting the hot work area for any change to previous conditions and conducting air monitoring if the hot work is performed in a Class 1 Location.

4.6.4 Hot Work Permit Applicability



4.6.5 Air Monitoring Program

- An Air Monitoring Program shall be developed before any Class 1 hot work is performed.

- The following information, which is documented in Section B of *S3AM-332-FM1 Hot Work Permit* or equivalent, shall be included in the Air Monitoring Program:
 - The area where the hot work shall be performed, including the specific points where the hot work will be performed.
 - All hot work equipment (ignition sources) and all potential sources of flammable gas within 50 feet (15.24 meters) of the hot work. Examples of potential sources of flammable gas include sumps, drains, flanges, valves, liquid boots, excavations and all confined areas and equipment located within them, such as floating roof pontoons, piping, excavations, vessels and boreholes or wells with potentially flammable gases.
 - The area that shall be monitored by the Authorized Air Monitor. At a minimum, this includes a 50-foot (15.24-meter) radius from the point of the hot work. Hot work in a confined space requires air monitoring for flammable gas throughout the entire space. Refer to *S3AM-301-PR1 Confined Spaces*.
- All air monitoring associated with hot work shall be conducted by an Authorized Air Monitor who is trained and competent in the use of the instrument and hazards of the monitored area.
- The instrument(s) used for air monitoring shall be calibrated by the Authorized Air Monitor prior to use, refer to *Q2-312-PR1 Monitoring and Measuring Equipment Procedure*. The Authorized Air Monitor shall maintain documentation of the calibrations in Section B –of *S3AM-332-FM Hot Work Permit* or equivalent form.
- Air monitoring equipment is to produce an audible alarm when LEL exceeds the established set point (e.g. 5 percent or 10 percent). The authorized air monitor shall remain in hearing range of the audible alarm and locate the air monitoring equipment between the hot work and potential vapor source. More than one instrument may be needed to monitor the air properly.
- Initial readings shall be recorded in Section B–of *S3AM-332-FM Hot Work Permit* or equivalent form prior to signing the permit. If readings are >0%, Section C – LEL Mitigation Plan or equivalent form shall be completed.

4.7 LEL Mitigation Plan

- 4.7.1 Section C of *S3AM-332-FM1 Hot Work Permit* documents the location of confirmed sources of flammable gas and the controls needed to eliminate, reduce or maintain the LEL reading to less than 10 percent (or 5% in certain jurisdictions) of the LEL.
- 4.7.2 An LEL Mitigation Plan shall be developed and implemented if the presence of flammable gas is detected (LEL greater than 0 percent) at any time during the hot work.
- 4.7.3 The following information shall be documented in Section C of *S3AM-332-FM1 Hot Work Permit* or equivalent form:
 - The percent of the LEL that was measured;
 - The identified source(s) of the flammable gas within the hot work area;
 - The controls, if any, that shall be implemented to effectively eliminate, reduce or maintain the flammability level to less than 10 percent (or 5% in certain jurisdictions) of the LEL within the hot work area; and
 - The percent LEL measured after controls, if any, have been implemented.

Note: If at any time the LEL reading is greater than or equal to the safety factor of 10 percent (or 5% in certain jurisdictions) of the LEL, the hot work shall stop immediately and shall not resume until controls are implemented to reduce the LEL level to less than the safety factor (as per jurisdiction, 5% or 10%) of the LEL.

4.8 Fire Watch Requirements

4.8.1 A Fire Watch is required whenever the hot work meets any of the following criteria:

- The hot work consists of PSI Class 1 hot work.
- The PSI hot work will be performed:
 - Within 50 feet (15.24 meters) of shielded combustible material;
 - Within a 50-foot (15.24-meter) radius of wall or floor openings that expose combustible materials;
 - Adjacent to metal partitions, walls, ceilings or roofs that are in contact with combustible materials on the other side and are likely to be ignited by conduction or radiation; or
 - Where fire alarms or suppression systems have to be disabled.

4.8.2 In some cases more than one fire watch may be necessary (e.g. various levels in a building). This shall be identified in the SH&E Plan and the THA.

4.8.3 The Fire Watch shall be in the ready position at all times while hot work is being performed. The ready position consists of the following:

- Being attentive to the hot work being performed.
- Properly positioning the fire extinguisher prior to the start of work.
- Always maintaining a line of sight to the hot work being performed.

4.8.4 The Fire Watch shall stop the work if he or she deems that:

- Unsafe conditions have developed.
- The work is exceeding the scope described in the Hot Work Permit.

4.8.5 A Fire Watch shall be maintained for at least 30 minutes after completion of hot work operations so that possible smoldering fire can be detected and extinguished.

4.8.6 They shall be familiar with facilities and procedures in the event of a fire. The Fire Department shall be immediately notified of all fires.

4.8.7 A second Fire Watch shall be required if one Fire Watch cannot directly observe combustible materials that could be ignited by the hot work operation.

4.9 PSI Hot Work

4.9.1 PSI hot work, such as grinding, has been known to generate sparks with enough force to transport them up to 50 feet (15.24 meters) from the point of the hot work; therefore, it is possible to perform PSI hot work up to 50 feet (15.24 meters) away from a Class 1 location and yet still introduce an ignition source into a Class 1 area.

4.9.2 Prior to performing PSI hot work, the following requirements shall be met and shall be verified by the permit writer:

- All combustible and flammable materials shall be relocated at least 50 feet (15.24 meters) in all directions from the job site.

4.9.3 If relocating these materials is impractical (e.g. equipment, walls, floors, etc.), the following precautions shall be taken:

- The materials shall be shielded with fire-retardant covers or with metal or fire-retardant guards or curtains.
- The edges of covers at the floor shall be tight to prevent the entrance of sparks, including at the point where several covers overlap when a large pile is being protected.

- NOTE: Consideration should be given to spark-containment techniques that lessen the distance sparks are able to travel freely (e.g., fire-retardant screens, guards, spark/slag catcher).
- A fully charged and operable fire extinguisher appropriate for the type of potential fire shall be available for use in the work area (20 pounds [9.07 kilograms] minimum), refer to *S3-NA-106-PR1 Fire Protection* procedure.
- A non-flammable, impervious material shall seal sewer openings, ducts and drains. Where sealing is insecure or impractical, water spray or stream should be directed across openings.
- The location of the hot work relative to combustible and flammable materials and classified areas shall determine the need for a Fire Watch, as outlined in this practice. Personnel within the vicinity of the hot work shall be suitably protected against such dangers as heat, sparks, flash and slag.

4.10 Preparation for PSI Class 1 Location Hot Work

- 4.10.1 Prior to performing any PSI Class 1 hot work, the requirements set forth for All PSI Hot Work and the relevant requirements of air monitoring of this practice shall be met and verified by the permit writer. Additional requirements include:
- The venting, draining or bleeding of flammable or combustible liquids and gases shall be stopped within 50 feet (15.24 meters) of the hot work.
 - Affected excavations, conduits and manholes within 50 feet (15.24 meters) of the hot work shall either be monitored for the presence of flammable gas or sealed to confirm that an ignition source is not introduced.
 - NOTE – Non-intrinsically safe tools (including cell phones) are prohibited from use in Class 1 Locations, except as defined in Initial and Continuous Hot Work Air Monitoring, regarding SSI Class 1 Hot Work.

4.11 Preparation for PSI Hot Work within 50 feet (15.24 meters) of Buildings or Other Structures

- 4.11.1 The conditions in Preparation for all PSI Hot Work shall be met and verified before any PSI hot work is performed inside or within 50 feet (15.24 meters) of buildings or structures with building materials or contents that may be combustible or flammable. Additional requirements include:
- Openings or cracks in walls, floors or ducts within 50 feet (15.24 meters) of the hot work shall be tightly covered with fire-retardant or non-combustible materials to prevent the passage of sparks to adjacent areas.
 - Ducts that might carry sparks to distant combustible or flammable materials shall be shielded, shut or both.
 - If hot work is performed near walls, partitions, ceilings or roofs of combustible materials, fire-retardant shields or guards shall be provided to prevent ignition.
 - If hot work is done on one side of a wall, partition, ceiling or roof, combustibles on the other side shall be relocated if possible. If it is impractical to relocate combustibles, a Fire Watch shall be provided on the side of the combustibles.
 - Hot work shall not be attempted on a partition, wall, ceiling or roof with a combustible covering or insulation, or on walls or partitions of combustible sandwich panels or similar construction.
 - If the hot work is close enough to cause ignition by conduction, it shall not be performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings roofs or other combustibles.
 - The following shall apply to hot work performed in close proximity to a sprinkler head:
 - A wet rag shall be laid over the sprinkler head and then removed at the conclusion of the

welding or cutting operation.

- Special precautions (e.g., ventilation, shielding) shall be taken during the hot work to avoid accidental operation of automatic fire suppression systems. Consultation with the building owner, system manufacturer or other authority may be required.

4.12 SSI Class I Location Hot Work

4.12.1 Periodic up to continuous air monitoring, as determined by the permit writer and documented on the Hot Work Permit Section B – *S3AM-332-FM1 Hot Work Permit* or equivalent form shall be performed and the results documented.

4.12.2 NOTE: Non-intrinsically safe tools (including cell phones) are prohibited from use in Class 1 areas, except as defined in Initial and Continuous Hot Work Air Monitoring, regarding SSI Class 1 hot work.

4.13 Air Monitoring (Class 1 Locations)

4.13.1 Flammable and combustible liquids and gases are present in Class 1 Locations. In order to perform hot work safely in these areas, initial and continuous air monitoring is required to confirm that any flammable gas in the work area is detected and properly controlled.

- Hot work is prohibited if air monitoring readings are greater than or equal to 10 percent of the LEL (or 5% in certain jurisdictions).

4.13.2 If the hot work will be performed in a tank or vessel, the air monitoring requirements for confined spaces shall apply. Refer to *S3AM-301-PR1 Confined Spaces*.

4.13.3 When the possibility exists for an oxygen-deficient atmosphere, the oxygen level could be below the level (10 percent oxygen) required by the air monitor to give the correct flammability (LEL) reading.

- Alternate testing methods shall be required to accurately assess the flammability hazard.
- This may occur where a tank, vessel or piping contains an inert gas such as nitrogen or carbon dioxide. For this reason, it is important to monitor oxygen levels prior to monitoring for LEL.

4.13.4 Continuous Hot Work Air Monitoring (PSI Class 1 Locations)

- All PSI Class 1 Location hot work requires attended continuous air monitoring while the hot work is being performed.
- An Air Monitor shall survey the perimeter of the permitted area at least once an hour. The survey shall cover at least a 50 feet (15.24 meters) radius from the point of the hot work.
- When not conducting a periodic perimeter survey, the authorized gas tester shall be primarily positioned between the hot work and any potential sources of flammable gas.
- NOTE: The use of several air monitors around the hot work should be considered, depending on the work location. If more than one continuous monitor is in use, only one instrument needs to be actively attended.
- Readings from continuous air monitoring and hourly surveys should be recorded on the Hot Work Permit, even if the monitors do not alarm and the readings do not differ from the initial air monitoring results.
- If initial air monitoring readings are 0 percent LEL, but continuous air monitoring indicates the presence of flammable gas (greater than 0 percent of the LEL), the hot work shall stop and an LEL Mitigation Plan shall be developed, documented, and implemented.
- If the implementation of the LEL Mitigation Plan controls the flammability level to the safety factor of less than 10 percent (or 5% in certain jurisdictions) of the LEL, the authorized gas tester will continue monitoring the area while hot work continues.

- If at any time the LEL reading reaches the safety factor (as per jurisdiction, 5% or 10%), the hot work shall stop until the source of the flammable gas is controlled to less than the jurisdictional safety factor of the LEL.
- During drilling operations, where the potential of flammable gas is known to exist, the borehole may be classified as a Class 1 Location and continuous gas monitor shall be used in the immediate proximity of the top of the hole.

4.13.5 Initial and Continuous Hot Work Air Monitoring (SSI Class 1 Locations)

- Vehicles, mobile plant equipment and other non-intrinsically safe equipment present potential ignition sources. Consequently, SSI hot work in Class 1 Locations (e.g., a tank dike) requires the completion of a Hot Work Permit and air monitoring.
- Air monitoring shall be performed for SSI hot work in Class 1 Locations:
 - Before a vehicle or equipment that is not intrinsically safe is allowed to enter the Class 1 area, an authorized gas tester shall survey the area along its planned path to its destination.
 - The vehicle or equipment can proceed into the classified area only when flammability readings are 0 percent LEL, or less than 10 percent (or 5% in certain jurisdictions) of the LEL with an implemented LEL Mitigation Plan.
- Continuous air monitoring shall be performed as long as the vehicle's engine or non-intrinsically safe equipment is running and initial monitoring is greater than 0 percent.
- If the vehicle or non-intrinsically safe equipment is shut off, it shall not be restarted until the area around the vehicle or non-intrinsically safe equipment is surveyed for flammable gas.
- The planned egress of the vehicle or equipment from the Class 1 Location shall be surveyed for flammable gas prior to its departure from the area.
- Periodic up to continuous air monitoring, as determined by the risk assessment, shall be performed and documented on the Hot Work Permit.

4.14 Welding and Cutting General Requirements

4.14.1 Avoid looking directly at the welding arc.

4.14.2 Avoid prolonged exposure to welding/paint fumes.

4.14.3 Avoid touching recently welded joints.

4.14.4 Welding/Cutting on Containers

- No welding, cutting, or other hot work shall be performed on empty drums, barrels, tanks, or other containers until they have been thoroughly cleaned and it is absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which, when subjected to heat, might produce flammable or toxic vapors. Any connection to the drum or vessel shall be disconnected or blanked off.
- All hollow spaces, vacancies, or containers shall be ventilated to remove gases before preheating, cutting, or welding. Purging with inert gas is recommended.
- In addition to the requirements presented in *S3AM-301-PR1 Confined Spaces*, welding/cutting in confined spaces such as a tank, boiler, pressure vessel, or small compartment shall require the following precautionary measures:
 - Local exhaust ventilation shall be provided, unless workers wear supplied-air respirators.
 - Gas cylinders and/or welding machines shall be placed outside the confined space.

4.14.5 If irritation or "red eye" occurs as a result of welder's flash, employees shall contact non-emergency medical support immediately through the applicable AECOM-dedicated line. Refer to *S3AM-004-*

PR1 Incident Reporting, Notifications & Investigation and S3AM-012-PR1 First Aid. Symptoms may include:

- Pain that may be mild to very severe;
- Bloodshot eyes;
- Light sensitivity;
- Watery eyes;
- Blurred vision; and
- The feeling of having something in the eye.

4.14.6 Employees should seek urgent medical help, in accordance with *S3AM-004-PR1 Incident Reporting* and *S3AM-012-PR1 First Aid*, if any of the following symptoms are experienced:

- Blurred vision;
- Vision changes;
- Seeing spots or flashes of light;
- Pain when moving eyes; and
- Worsening pain.

4.15 Gas Welding and Cutting Safety Requirements

- 4.15.1 Fuel-gas hoses and oxygen hoses shall be easily distinguishable from each other. The contrast shall be made by different colors or by surface characteristics readily distinguishable by touch. Oxygen and fuel-gas hoses shall not be interchangeable. A single hose having more than one gas passage shall not be used.
- 4.15.2 When parallel sections of oxygen and fuel-gas hose are taped together, not more than 4 inches (10 centimeters) out of 12 inches (30.5 centimeters) shall be covered by tape.
- 4.15.3 All hoses in use shall be inspected at the beginning of each work shift. Defective hose shall be immediately removed from service.
- 4.15.4 Hoses, cables, and other equipment shall be kept clear of walkways, ladders, and stairs.
- 4.15.5 Clogged torch tip openings shall be cleaned with approved cleaning wires, drills, or other devices designed for this purpose.
- 4.15.6 Torches to be used shall be inspected at the beginning of each work shift for leaking shutoff valves, damaged hose couplings, and clogged tip connection. Defective torches shall not be used.
- 4.15.7 Torches shall be ignited by friction lighters or other approved devices only. Matches and, flame lighters shall not be used to ignite a torch.
- 4.15.8 Oxygen and fuel-gas pressure regulators, including related gauges, shall be in proper working order and equipped with "Flashback" arrestors attached to the gauges. NOTE: Flashback arresters are in addition to "Backflow" devices.
- 4.15.9 All oxygen cylinders and fittings shall be kept away from oil or grease.
 - Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves.
 - Oxygen shall not be directed at oily surfaces or greasy clothes, or used within a fuel oil or other storage tank or vessel.
- 4.15.10 Torches and hoses shall be completely depressurized (bled) of pressurized gas, prior to storage, or at the end of each shift.

- 4.15.11 Torches and hoses shall not be stored in enclosed areas (e.g., gang boxes, lockers) while connected to cylinders and gauges shall be removed at the end of shift.
- 4.15.12 Oxygen connections shall include a means to prevent backflow.
- 4.15.13 Fuel-gas cylinders shall be provided flashback protection.
- 4.16 Arc Welding and Cutting Safety Requirements
 - 4.16.1 Electrode holders that are designed for arc welding/cutting and are capable of safely handling the maximum rate current shall be used.
 - 4.16.2 Any current-carrying parts passing through the holder which the arc welder or cutter grips in his/her hand, or the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered and properly grounded.
 - 4.16.3 Grounding is required of the welding machine and the welding circuit.
 - Grounding the welding machine is not required if the machine is not double insulated, as indicated by the box-within-box symbol on the rating plate.
 - The ground clamp or ground lead (separate from the workpiece connection or workpiece lead) shall connect the workpiece, or the metal table the workpiece rests upon, to a suitable ground, such as a metal building frame.
 - 4.16.4 All arc welding/cutting cables shall be completely insulated and flexible, capable of handling the maximum current requirements of the work.
 - 4.16.5 Only cables free from repair or splices for a minimum distance of 10 feet (3 meters) from the electrode holder shall be used. Cables with standard insulated connectors or splices with insulating quality that is equal to that of the cable are permitted.
 - 4.16.6 If it is necessary to splice lengths of cable, insulated connectors equivalent to that of the cable shall be used. If connections are made by cable lugs, they shall be securely fastened together and provide good electrical contact. Exposed metal parts of the lugs shall be completely insulated.
 - 4.16.7 If electrode holders are left unattended, the electrodes shall be removed and the holder placed so that they cannot make electrical contact with employees or conducting objects.
 - 4.16.8 To avoid the possibility of electric shock, particularly in humid or damp environments, appropriate and dry PPE shall be worn. Electrode holders shall not be dipped in water.
 - 4.16.9 When the arc welder or cutter leaves work, stops work for any length of time, or when the arc welding cutting machine is to be moved, the power supply to the equipment shall be turned off.
 - 4.16.10 Any faulty or defective equipment shall be reported to the Supervisor and tagged out of service until repaired.
 - 4.16.11 All arc welding/cutting operations shall be shielded by non-combustible or flameproof screens to protect employees and other persons working in the vicinity from the direct ray of the arc.
- 4.17 Storage and Handling of Compressed Gas Cylinders
 - 4.17.1 Compressed gas cylinders shall be legibly marked with either the chemical or trade name of the gas in accordance with Globally Harmonized System (GHS) or Workplace Hazardous Materials Information System (WHMIS) standardized labelling. Such markings will be stenciled, stamped, or labelled and shall not be easily removable.
 - 4.17.2 The marking shall be located on the shoulder of the cylinder.
 - 4.17.3 Compressed gas cylinders shall be equipped with approved connections.
 - 4.17.4 Acetylene cylinders shall be stored and used valve end up.
 - 4.17.5 Cylinders shall not be stored near highly combustible/flammable materials, especially oil or grease.

- 4.17.6 All cylinders shall be stored in an upright and secured position (with chains) with caps installed and separated from fuel-gas cylinders or combustible materials (especially oil or grease), by a minimum distance of 20 feet (6 meters), or by a non-combustible barrier at least 5 feet (1.5 meters) high and having a fire-resistance rating of at least one half hour.
- 4.17.7 Cylinders shall be not dropped, struck by objects, or permitted to strike each other violently.
- 4.17.8 Cylinder valves shall be closed, gauges removed and caps installed before moving cylinders.
- 4.17.9 Cylinder valves shall be closed and gauges removed at the end of the shift or when work is finished.
- 4.17.10 Valves of empty cylinders shall be closed.
- 4.17.11 Cylinders shall be kept far enough away from the actual welding/cutting operation so that sparks, hot slag, or flames shall not reach them.
- 4.17.12 Cylinder valves shall always be opened slowly.
- 4.17.13 An acetylene cylinder valve shall not be opened more than one and one-half turns of the valve stem and preferably no more than three-fourths of a turn.
- 4.17.14 Do not use acetylene at a pressure in excess of 15 pounds per square inch (psi) gauge pressure, or 30 psi absolute.
- 4.17.15 Where a special wrench is required to operate a cylinder valve, it shall be left in position on the stem of the valve while the cylinder is in use. In the case of manifolded or coupled cylinders, at least one such wrench shall be available for immediate use.
- 4.17.16 Regulators shall be removed, valve caps in place, and valves closed when cylinders are transported by vehicles. All vehicles used to transport cylinders shall have a proper support rack installed.
- 4.17.17 A suitable cylinder truck, chain, or other steadying device shall be used to prevent cylinders from being knocked over while in use.
- 4.17.18 Cylinders shall not be placed where they may become part of an electric circuit. Tapping of an electrode against a cylinder to strike an arc shall be prohibited.
- 4.17.19 Only use warm, not boiling, water to thaw cylinders and valves.
- 4.17.20 Pressure Reducing Regulators:
 - Pressure regulators, including the gauges, shall be in proper working order while in use. If not, immediately remove from service.
 - Regulators shall be of an approved type for the type of gas to be utilized.
 - When a pressure-reducing regulator is attached to a compressed gas cylinder, the cylinder valve shall be opened just slightly at first, so that the regulator can take on pressure slowly. After which, the valve may be turned open to its normal position. If the regulator takes on pressure too quickly, it can damage the regulator and pressure gauges.
 - The operator shall stand to the side of glass covered gauges and not in front of them.
- 4.17.21 Manifolding of Cylinders
 - Cylinder manifolds shall be installed under the supervision of a qualified person(s) and shall comply with proper practices in construction and use.
 - All manifolds and parts shall be appropriate for the gases for which they are approved.
 - When acetylene cylinders are manifold, approved flashback arresters shall be installed between each cylinder and the coupler block. One flash arrestor installed between the coupler block and regulator is acceptable only for outdoor use or if the number of cylinders coupled does not exceed three.

- Each cylinder lead shall be provided with a backflow check valve.

4.18 Mechanical Ventilation

- 4.18.1 Mechanical ventilation shall consist of either general dilution systems or local exhaust systems. Local exhaust systems are preferred. The applicable SH&E Plan shall identify ventilation requirements suitable to the work environment and anticipated hazards.
- 4.18.2 Mechanical ventilation shall be of sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fume and smoke within safe limits.
- 4.18.3 General dilution ventilation may not be used as the only means of control when toxic metals are involved in the operation.
- 4.18.4 Local exhaust ventilation shall consist of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. This system shall be of sufficient capacity and so arranged as to remove fumes and smoke at the source and keep the concentration of them in the breathing zone within safe limits
- 4.18.5 Contaminated air exhausted from a working space shall be discharged into the open air or otherwise clear of the source of intake air. Environmental regulations may require filtering or other cleaning of exhausted air.
- 4.18.6 All makeup air shall be clean and suitable for breathing.
- 4.18.7 Oxygen shall not be used for ventilation purposes, comfort cooling, blowing dust from clothing, or for cleaning the work area.
- 4.18.8 The Supervisor shall provide appropriate methods and controls in the case of specific requirements (including welding rods and fluxes, paints and coatings) for materials containing zinc, lead, mercury, beryllium, cadmium, and stainless steel to be cut, heated, and/or welded.

5.0 Records

- 5.1 Retain completed *S3AM-332-FM1 Hot Work Permit* or equivalent form in the project files.
- 5.2 Documentation of employee training completed shall be retained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

- 6.1 [S3AM-332-FM1 Hot Work Permit](#)

Americas

Hot Work Permit

S3NA-332-FM1

Name of Contractor: _____	Location: _____	Project #: _____
Date: _____	Time: _____	Weather: _____
Person Preparing Permit: _____	Title: _____	THIS PERMIT BECOMES VOID: 1. At the end of the shift, or 2. Whenever conditions change significantly, or 3. On any emergency signal
Person Conducting Hot Work: _____	Title: _____	

TYPE OF HOT WORK

☐ **PSI CLASS I Location** (Complete full permit)
 ☐ **PSI NON-CLASS I Location** (Complete section A, D, and E)
 ☐ **SSI CLASS I Location** (Complete section B, and E)

Description of Hot Work to be Conducted:**A. WORK AREA PREPARATION FOR HOT WORK**

	YES	NO	N/A
1. Is the hot work equipment in proper working order?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Are the proper safety data sheets (SDS) available for review?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Have combustible materials been relocated more than 50 feet (15.24 meters) from hot work or been properly shielded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Is firefighting equipment readily available and in proper working order (e.g. fire extinguishers, sand, shovels, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Have ducts, drains, and sewers been adequately covered to prevent sparks from entering?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. If hot work is to be performed indoors, have combustible floors been wet down or properly shielded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. If arc welding equipment will be used, have measures been taken to protect personnel from shock?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. If required, is a 20-pound (9.07-kilogram) fire extinguisher available and appropriate for the type of fire expected?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. If hot work is to be performed in or on containers, vessels, tanks, or similar equipment, have they been cleaned, purged, or ventilated, or have other precautions been taken to verify that they are safe for hot work?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. If required, have lockout tagout procedures been completed in accordance with <i>S3NA-325-PR1 Lockout Tagout</i> ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Have others required to work in the hot work area been notified of the work involved and safety precautions, and do they have the required PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

LIST ANY PERSONAL PROTECTIVE EQUIPMENT THAT IS REQUIRED (OTHER THAN THE MINIMUM REQUIRED):

B. AIR MONITORING**(Initial and continuous monitoring are required for all Class I Hot Work [PSI and SSI])**

DOCUMENT WHERE AIR MONITORING WILL OCCUR, WHAT POTENTIAL GAS OR VAPOR SOURCES EXIST WITHIN THE HOT WORK AREA, AND THE WIND DIRECTION:

INSTRUMENT 1 SERIAL
NUMBERS: _____DATE AND RESULTS OF LAST
CALIBRATION: _____PRE-USE CALIBRATION
CHECK PERFORMED: _____**YES NO NA**
circleINSTRUMENT 2 SERIAL
NUMBERS: _____DATE AND RESULTS OF LAST
CALIBRATION: _____PRE-USE CALIBRATION
CHECK PERFORMED: _____**YES NO NA**
circle**Initial Reading %LEL (if >0% fill out section C)**

If O ₂ level below 10% do not proceed without alternate testing	Time	%O ₂	%LEL	Time	%Oxygen	%LEL	Time	%Oxygen	%LEL

Continuous Reading %LEL

Time	%LEL	Time	%LEL	Time	%LEL	Time	%LEL	Time	%LEL

C. LOWER EXPLOSIVE LIMIT (LEL) MITIGATION PLAN**(Required if initial or continuous monitoring LEL is greater than 0%)**

% LEL DETECTED:		% LEL AFTER CONTROLS IMPLEMENTED		NOT APPLICABLE		(If not applicable, continue monitoring source)
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DOCUMENT THE LOCATION OF CONFIRMED SOURCE(S) OF GAS / VAPOR AND WHAT CONTROLS (IF ANY) HAVE BEEN IMPLEMENTED *(Note: Hot work is prohibited if the LEL reading is greater than or equal to 10% in the hot work area.)*

D. FIRE WATCH			
	YES	NO	
1. Will PSI Class I work be performed?			<i>Note: If the answer to any of the fire watch conditions to the left is YES, a dedicated fire watch must be assigned.</i>
2. Will PSI Non-Class I work be performed within 50 feet (15.24 meters) of combustible materials?			
3. Will PSI hot work be performed where wall or floor openings within 50 feet (15.24 meters) would compose combustibles in adjacent areas?			<i>Note: The fire watch is authorized to perform air monitoring.</i>
4. Is PSI hot work to be performed where combustibles are adjacent to the opposite side of partitions, ceilings, or roofs being worked on?			Fire Watch 1:
			Fire Watch 2:
5. Will fire alarms or suppression systems be disabled for hot work?			

E. AUTHORIZING SIGNATURES							
AUTHORIZED AIR MONITOR: <i>I have performed initial air monitoring with a survey of the hot work area. I agree to perform continuous air monitoring and record results on this form while hot work is being performed in a Class I area and to stop hot work if the LEL reading is greater than or equal to 10%.</i>							
Name		Signature		Name		Signature	
FIRE WATCH: <i>I have been trained in the use of the applicable fire fighting equipment and agree to maintain a line of sight with the hot work operation at all times, to have immediate access to a fire extinguisher and to remain at the hot work area for 30 minutes after the hot work is completed to verify the area if fire safe.</i>							
Name		Signature		Name		Signature	
HOT WORK OPERATORS: <i>I have reviewed and understand the permit conditions specific to the scope of work. I agree to perform hot work operations within these conditions, to stop any work that I deem to be unsafe, and to notify the performing authority upon completion or interruption of this permitted work.</i>							
Name		Signature		Name		Signature	
Name		Signature		Name		Signature	
SITE SUPERVISOR: <i>The location where this work is to be done has been examined, necessary precautions have been taken, and permission is granted for this work.</i> <i>Permit Expires:</i>							
Name		Signature		Time Hot Work Started		Time Hot Work Completed	

Compressed Air Systems & Testing

S3AM-337-PR1

1.0 Purpose and Scope

- 1.1 The purpose of this procedure is to require the safe use of compressed air systems, including air compressors, during both normal operations and when used as a tool in the pneumatic testing of constructed piping systems.
- 1.2 This procedure applies to AECOM Americas employees on construction projects where air compressors are used or pneumatic testing with compressed air is performed.

2.0 Definitions

- 2.1 None

3.0 References

- 3.1 None

4.0 Procedure

- 4.1 Implementation of this procedure is the responsibility of the manager directing activities of the facility, site, or project location.
- 4.2 Air Compressor Safety
 - 4.2.1 Do not modify air compressors without prior written authorization from the manufacturer.
 - 4.2.2 Confirm air receivers of air compressor systems are equipped with a functional and readily visible pressure gauge, as well as one or more spring-loaded safety valves capable of preventing the maximum allowable working pressure of the receiver from being exceeded by more than 10% or as specified by the applicable jurisdiction.
 - 4.2.3 Check couplings daily before use. Use only couplings designed for compressed air services. All hose couplings shall be provided with a positive locking device (whip checks between hoses and on all couplers).
 - 4.2.4 Check hoses daily before use. When using compressed air, use only hoses designed for compressed air service. Take precautions that include the following:
 - Check all hoses for cuts, breaks, and loose connections before assembling the system.
 - Do not crimp, couple, or uncouple hoses while pressurized.
 - Unless the equipment has quick-change connectors (with internal check valves), shut off air at the air supply valve ahead of the hose before breaking the connection.
 - When possible, route airlines and hoses through areas with little or no vehicular or pedestrian traffic. Do not lay air hoses across roadways unless they are protected from traffic.
 - Suspend airlines and hoses crossing pedestrian walkways at least 7 feet (2.13 meters) above the ground or floor, or provide trip protection.
 - Provide all hoses exceeding ½ inch (1.25 cm) inside diameter with a safety device (an excess flow valve) at the source of supply or branch line to reduce pressure in case of hose failure. Equip all air hose connections over 1 inch (2.54 centimeters) in diameter with safety chains or an equivalent restraint that is secured when the connection is made.
 - Hoses equipped with special connections require special tightening techniques or equipment. One example is hammer union connection, which will be tightened with a hammer. Another example is spanner wrench connections, which will be tightened with a spanner wrench. Do

not tighten these or similar connections by hand.

- Secure hose connections before turning on air valves.
- Do not direct air hoses at personnel
- Confirm that air hose connections that are designed to accept a pin are securely pinned in the holes provided to prevent disconnection.
- When hanging an air hose in the vertical position, support hose connections above and below the connections to prevent the weight of the hose from pulling the connection apart, or pulling the connection out of the hose.

- 4.2.5 Compressed air for cleaning will not exceed 30 pounds per square inch (psi) [2.11 kilograms per square centimeter (kg/cm²). Use monogoggles or a face shield over safety glasses when cleaning with compressed air. Do not use compressed air to clean harmful dust or fibers that could be dispersed such as lead or asbestos.
- 4.2.6 Equip blowguns with an automatic shut off so that if the operator releases the blowgun, it shuts off (e.g., kill switch, dead man switch).
- 4.2.7 Equip each compressor with a properly sized relief valve maintained according to local, state, and federal regulations.
- 4.2.8 Open drain valves on air receivers in accordance with manufacturer's recommendations and at appropriate intervals to prevent excessive accumulation of liquid in the air receiver.
- 4.2.9 Provide and wear hearing protection if the air compressor and/or the compressed air create a noise level over 85 decibels.
- 4.2.10 Shut off air compressors and provide a fire extinguisher shall be accessible during refueling.

4.3 Pneumatic Testing with Compressed Air

- 4.3.1 Pneumatic testing of constructed systems uses pressurized air. At pressures most frequently encountered on AECOM locations, the amount of energy contained in air is more than 1,000 times the energy contained in water at the same pressure and volume. For this reason, hydraulic pressure testing is by far the safest method and should be used whenever possible. Pneumatic testing is potentially dangerous and should be carried out only in circumstances where the use of this method is unavoidable, and when the testing procedure has been approved by the SH&E Manager.
- 4.3.2 This document is intended to provide advice on the precautions necessary during pneumatic testing to avoid conditions likely to result in danger to personnel in the field. The advice given, however, is limited to general principles and does not attempt to cover in detail the wide range of conditions that may arise. The test system volume, test pressure, the type of components, test temperature, and the materials of construction are factors that have a bearing on the degree of danger involved, and the precise nature of the precautions to be taken.
- 4.3.3 Where practical, take steps to reduce to a minimum the internal volume of the system to be tested. This has the effect of reducing the energy stored in the system while under pressure, thereby reducing the consequences in the event of component failure. This can often be achieved by breaking a large system down into smaller systems. Care should be taken to confirm that openings in the test unit or system are adequately secured and sealed before starting a test.
- 4.3.4 Approval
 - Approval for pneumatic testing will be based on a review of the submitted test documents to determine the dangers involved in each test. In most cases, the SH&E manager will need to examine the proposed test installation before approving a pneumatic test.
 - The SH&E manager may stipulate additional safety requirements for a test that is not covered by this procedure, or for any special site conditions that may be encountered.

- If test pressure is greater than 200 pounds per square inch gauge (psig) (14.1 kilograms per square centimeter gauge [kg/cm²g]), test shall not be performed without the approval of both the Project Engineer and the SH&E manager.

4.4 Notification

4.4.1 The SH&E manager shall be notified by the Test Engineer prior to any pending pneumatic test(s), and sufficiently in advance of the proposed test to allow familiarization with the test conditions in each circumstance, and to expedite timely approval. The test package will be reviewed by the SH&E manager or his designee. Each test package will contain the following:

- Type of components being tested
- Materials of construction
- Test system volume
- Test pressure (full and reduced for examination; should be less than 200 psig (14.1 kg/cm²g))
- Test temperature (ambient at test unit maximum and minimum)
- Testing medium
- Test location
- Any applicable special site conditions and/or circumstances that might be applicable to the particular package.

4.4.2 Codes and Specifications

- Perform pneumatic testing in accordance with American Society of Mechanical Engineers (ASME) B31.3, Compressed Gas Association (CGA) C10, and the project specifications.

4.4.3 Responsibility for Monitoring Safety Procedures

- Designate a Test Engineer to coordinate and monitor each pneumatic test or group of tests. The Test Engineer will also be responsible for, but not limited to, the following:
 - Coordinating test personnel.
 - Making personnel aware of the test before it begins, and the hazards involved in conducting the test.
 - Obtaining approval of the necessary testing documents.
 - Ensuring that all safety devices and test instruments have been properly sized and calibrated, and are in place for the test.
 - Reviewing and implementation of the required safety procedures for each test.
 - Notifying all required witnesses in time for the test.
 - Verifying that QA/QC has accepted the welds on the system.
 - Protecting adjacent circuits designed for lower pressure from possible over-pressure.
 - Checking the material used to connect the test medium to the circuit being tested.
 - Maintaining an accurate record of the test and obtaining signatures of the test witnesses.

4.5 Limits for Pneumatic Testing

4.5.1 The safety limits for pneumatic testing are difficult to define because the magnitude of a catastrophic failure is indefinable in exact terms until after it has occurred. The extreme cautions necessary to provide complete protection to personnel and property during a pneumatic test are generally not practical (i.e., build special test bunkers around the test unit, or not allowing personnel within 10,000 feet [3,050 meters] of the test, etc.). Some compromises may be necessary in conducting a pneumatic test while providing maximum protection to life and property without causing project costs and schedules to become unreasonable.

4.5.2 Discussion by all the parties involved based on good judgment and some reasonable guidelines is mandatory prior to undertaking any pneumatic test. It should be remembered that the degree of

hazard in pressure systems is proportional to the amount of energy stored, not the amount of pressure present. Therefore, low-pressure, high- volume systems can be as hazardous to personnel as high- pressure systems.

4.5.3 Pressure-Relieving Devices

- The Test Engineer shall confirm that a pressure relief valve (with the discharge directed away from personnel) is fitted in the supply line between the test assembly and the compressor. The valve shall relieve at a pressure approximately 10 percent greater than the test pressure.
- The Test Engineer, prior to the test, shall verify the relief valve set point. The inlet diameter of the relief valve shall be at least 5 percent greater than the diameter of the pressure line from the compressor to the test unit or assembly. A properly designed rupture disk for the appropriate pressure may be used in place of the relief valve, using the same restrictions as noted above.

4.5.4 Testing Procedure

- Pneumatic test below 50,000 P.V. limit (pressure [P] in pounds per square inch gauge [psig] times volume [V] in cubic feet) and less than 200 psig (14.1 kg/cm²g) can be completed during the work shift with the following precautions:
 - Notify work crews in the area of the test.
 - Do not allow welding or burning within 2 feet (0.61 meter) of the line under pressure.
 - Place "DO NOT OPERATE" tags on all boundary valves.
 - Place red barricade tape (DANGER – DO NOT ENTER) at test station areas, secondary gauge area, and "high traffic" areas. After the test is complete and the pressure is removed from the test system, remove the signs and barricade.
- Tests that have a pressure greater than 200 psig and below 50,000 P.V. will require the following precautions:
 - The SH&E manager will walk the system before the 200 psig (14.1 kg/cm²g) limit is exceeded. The walk-down will be with a representative of the test crew and will include, but not be limited to, checks for tags, blinds, proper instruments and their placement, employees working in the area, and flagging or barricades.
 - Place "DO NOT OPERATE" tags on all boundary valves.
 - Place red barricade tape (DANGER – DO NOT ENTER) a minimum of 50 feet (15 meters) from the test area with signs signifying pneumatic testing.
 - No one, except the test crew checking the system and the SH&E manager or his designee, will be allowed to violate a pneumatic test barricade.
 - Use monitors, as necessary, to confirm the barricades are not violated.

5.0 Records

5.1 The following documentation will be maintained in the location or project file:

- 5.1.1 Tests of safety valves on air receivers.
- 5.1.2 Test packages indicating components being tested, materials of construction, and test conditions.
- 5.1.3 Written approvals for pneumatic testing by SH&E manager and Test Engineer (if test pressure greater than 200 psig (14.1 kg/cm²g) is used).
- 5.1.4 Test record and results, including signatures of test witnesses.

6.0 Attachments

6.1 None

Concrete

S3AM-338-PR1

1.0 Purpose and Scope

- 1.1 The purpose of this procedure is to confirm the safety of AECOM Americas personnel during the installation of concrete forms, pouring of new concrete structures, or installation of preformed concrete structures.
- 1.2 This procedure applies to AECOM Americas employees where concrete is poured or handled. This procedure also applies to Portland cement, mortar, stucco, and other applications of cementitious products.

2.0 Definitions

- 2.1 None

3.0 References

- 3.1 S3AM-208-PR Personal Protect Equipment
- 3.2 S3AM 304 PR1 Fall Protection

4.0 Procedure

- 4.1 Implementation of this procedure is the responsibility of the manager directing activities of the facility, site, or project location.
- 4.2 General
 - 4.2.1 Employees working above any adjacent working surfaces shall review and conform to the applicable fall protection requirements listed in *S3AM 304 PR1 Fall Protection*.
 - 4.2.2 No employees will be permitted to work above an impalement hazard (e.g., rebar) unless it has been protected to eliminate the hazard of impalement.
 - 4.2.3 Prohibit riding of concrete buckets for any purpose. Keep vibrator crews out from under concrete buckets suspended from cranes or cableways.
 - 4.2.4 Provide an employee with a whistle or other sound-producing device to watch for approaching buckets and warn employees to stand clear while the concrete is dumped.
 - 4.2.5 Where practical, use tag lines to control and position suspended concrete buckets.
 - 4.2.6 Provide PumpCrete™ or similar systems using discharge pipes with pipe supports designed for 100 percent overload. Provide compressed-air hoses in such systems with positive fail-safe joint connectors, or otherwise secure them to prevent separation of sections when pressurized.
 - 4.2.7 All nozzle men applying cement, air, sand and water through a pneumatic or high-pressure hose shall wear protective head, hand, and face equipment.
 - 4.2.8 All concrete workers shall wear protective clothing, including safety glasses; rubber boots, and gloves, to reduce the danger of concrete burns. Refer to *S3AM-208-PR Personal Protection Equipment* for additional information.
 - 4.2.9 Wear appropriate personal protective equipment when using tools and equipment associated with concrete masonry work.
 - 4.2.10 Finishers shall wear safety glasses and face shields when chipping, wire brushing, or using power-impact or rotary tools in patching concrete.
 - 4.2.11 In the pour area, or any area where dry Portland cement is being handled or mixed with water or aggregate, provide means to flush eyes (e.g., eyewash station, bottles) for 15 minutes. If the

material contacts skin, wash skin with water and ph-neutral soap or mild detergent.

- 4.2.12 Provide temporary winter protection enclosures with adequate ventilation, lighting, and fire protection.
- 4.2.13 Equip pavers with a loud warning bell or horn that sounds when a paver moves ahead or the bucket is run out.
- 4.2.14 Provide conical or tapered bottoms with mechanical or pneumatic means of starting the flow of materials for bulk storage bins, containers, or silos.
- 4.2.15 Construct handles on bull floats used where they may contact energized electrical conductors of nonconductive material, or insulate with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of nonconductive material.
- 4.2.16 Do not extend handles of buggies beyond the wheels on either side of the buggy. Installation of knuckle guards on buggy handles is recommended.
- 4.2.17 Provide concrete buckets equipped with hydraulic or pneumatically operated gates with positive safety latches or similar safety devices installed to prevent premature or accidental dumping. The buckets will be designed to prevent excess aggregate and loose material from accumulating excessively on the top and sides of the bucket.
- 4.2.18 Block the wheels of ready-mix trucks and set the brakes to prevent movement when discharging on a slope.
- 4.2.19 Properly guard exposed gears, chains, and rollers of mixers.
- 4.2.20 Secure sections and ends of tremies, elephant trunks, and similar concrete conveyances with wire rope, chain, or similar safe fastener.
- 4.2.21 Equip powered and rotating-type concrete troweling machines that are manually guided with a control or dead-man switch that will automatically shut off the power whenever the operator removes his hands from the equipment handles.
- 4.2.22 The use of ready-mix concrete trucks may create traffic problems, which proper planning and care can lessen and/or eliminate. Control backing operations through the use of a properly trained and attired flag person/spotter who will be positioned so that they have a clear view of the area behind the truck, as well as be clearly visible to the truck driver. Route movement of personnel and project equipment away from this area so that they do not have to cross the truck's means of egress.

4.3 Forms and Shoring

- 4.3.1 The completed shoring setup should be a homogenous unit or units. For example, do not use tubular steel shoring in combination with adjustable wood or jack-type shoring.
- 4.3.2 Confirm that formwork and shoring are be designed, erected, supported, braced, and maintained so that they will safely support all vertical and lateral loads that may be imposed upon them during placement of concrete.
- 4.3.3 Confirm that drawings or plans showing the jack layout, formwork, shoring, working decks, and scaffolding are available at the jobsite.
- 4.3.4 Remove and stockpile stripped forms and shoring promptly after stripping in all areas in which persons are required to work or pass. Remove and dispose of adhered concrete from forms and planking before stacking when possible to prevent generation of concrete dust. Pull, cut, or remove by other means any protruding nails, wire ties, and other form accessories not necessary to subsequent work to eliminate the hazard.
- 4.3.5 Do not impose any construction loads on the partially completed structure unless such loading has been considered in the design and approved by the engineer-architect.
- 4.3.6 When temporary storage of reinforcing rods, material, or equipment on top of formwork becomes necessary, strengthen these areas to meet the intended loads.

- 4.3.7 Provide sills for shoring that are sound, rigid, and capable of carrying the maximum intended load.
- 4.3.8 Inspect all shoring equipment prior to erection to determine that it is as specified in the shoring layout. Do not use any equipment for shoring that is found to be damaged.
- 4.3.9 Inspect erected shoring equipment immediately prior to, during, and immediately after the placement of concrete. Immediately reinforce or re-shore any shoring equipment that is found to be damaged or weakened.
- 4.3.10 Provide re-shoring when necessary to safely support slabs and beams after stripping, or where such members are subjected to superimposed loads due to construction work done.
- 4.3.11 Build shoring or form systems in accordance with the AECOM procedure governing excavation when working in excavations.
- 4.4 Tube and Coupler Shoring
 - 4.4.1 Use tubular steel frames for shoring layouts in accordance with each manufacturer's recommended safe working load based on tests conducted according to the "Recommended Procedure for Compression Testing Scaffolds and Shores" by the Scaffolding and Shoring Institute.
 - 4.4.2 Prior to erection of steel frame shoring, conduct a thorough inspection to confirm material is not heavily rusted, bent, dented, or otherwise damaged or defective.
 - 4.4.3 Provide final adjustment of adjustment screws prior to placement of concrete. Keep screw extensions to a minimum for maximum load carrying capacity.
 - 4.4.4 Plan, design and construct any form, regardless of size, with an adequate factor of safety.
 - 4.4.5 Do not use couplers (clamps) if they are deformed, broken, have defective or missing threads on bolts, or other defects.
 - 4.4.6 Use material for the coupler (clamps) that is of a structural type such as drop forged steel, malleable iron, or structural grade aluminum. Do not use gray cast iron.
 - 4.4.7 When checking the erected shoring towers with the shoring layout, confirm that the spacing between posts does not exceed that shown on the layout; check all interlocking of tubular members and tightness of couplings.
 - 4.4.8 Confirm that all base plates, shore heads, extension devices, or adjustment screws are in firm contact with the footing sill and the form material, and are snug against the posts.
- 4.5 Vertical Slip Forms
 - 4.5.1 Confirm that the steel rods or pipe on which the jacks climb or by which the forms are lifted are designed specifically for that purpose. Brace any rods not encased in concrete.
 - 4.5.2 Position jacks and vertical supports in such a manner that the vertical loads are distributed equally and do not exceed the capacity of the jacks.
 - 4.5.3 Provide the jacks or other lifting devices with mechanical dogs or other automatic holding devices to provide protection in case of failure of the power supply or the lifting mechanism.
 - 4.5.4 Lift steadily and uniformly, and do not exceed the predetermined safe rate of lift.
 - 4.5.5 Provide lateral and diagonal bracing of the forms to prevent excessive distortion of the structure during the jacking operation.
 - 4.5.6 During jacking operations, the form structure shall be maintained in line and plumb.
 - 4.5.7 Provide all vertical lift forms with scaffolding or work platforms completely encircling the area of placement.
- 4.6 Pre-Stressed and Post-Stressed Concrete
 - 4.6.1 Keep tools and strand devices clean and in good repair to prevent failure.

- 4.6.2 Do not permit employees to stand in line or directly over the jacking equipment during tensioning operations. Provide signs and barriers to prevent employees from working behind the jack. Shield all jacking equipment and attachment pieces to protect the workers performing the stressing operations.
- 4.6.3 Carefully stack stressed members on a level base.
- 4.6.4 Pre-stressed girders and beams are often unstable when tipped; brace during transportation and handle in such a way to keep the member upright.
- 4.6.5 Handle stressed members at pick points specifically designated on the manufacturer's drawings, and with the lifting devices recommended by the manufacturer or the engineer in charge.
- 4.6.6 Do not allow personnel under stressed members during lifting and erection.
- 4.6.7 Keep anchor(s) turned up close to the anchor plate during jacking operations of any tensioning element(s).
- 4.6.8 Frequently inspect pulling heads, bolts, and hydraulic rams for indication of fatigue, and the threads on bolts and nuts for diminishing cross section.
- 4.7 Pre-Cast Concrete and Tilt-Up Operations
 - 4.7.1 Do not permit employees under pre-cast walls, panels, or sections while they are being lifted or tilted into position.
 - 4.7.2 Use properly attached tag lines, especially if the load is to be lifted and moved into place.
 - 4.7.3 Adequately brace pre-cast walls or vertical concrete panels during construction.
 - 4.7.4 Securely attach braces or shores to the concrete member.
 - 4.7.5 Confirm lifting inserts on or in tilt-up pre-cast concrete members are capable of supporting at least two (2) times the maximum intended load applied or transmitted to them.
 - 4.7.6 Confirm lifting hardware can support at least five (5) times the maximum intended load applied or transmitted to the lifting hardware.
- 4.8 Masonry Work
 - 4.8.1 Handle and store masonry building materials in accordance with AECOM procedures for material handling; scaffolds for masonry construction shall be built in accordance with the AECOM procedures for scaffolding.
 - 4.8.2 Equip power saws for cutting brick or stone with dust collectors or wet cutting methods to control dust. The exhausted dust will be directed away from vehicle or personnel traffic. If brick, stone, or mortar contains more than 1 percent crystalline silica, respirators may be required until air sampling determines that the task does not constitute a potential respiratory hazard.
 - 4.8.3 Employees cutting brick or stone shall wear approved safety goggles or face shields over safety glasses, and hearing protection as appropriate for the task noise levels.
 - 4.8.4 Keep mortar tubs free from ragged edges that may cut the hands, legs, and arms of bricklayers.
 - 4.8.5 Properly brace all walls or vertical surfaces during construction to withstand wind and other pressure.
 - 4.8.6 Dried mortar will not be dropped from planks, crushed by vehicles, or otherwise handled in such a manner as to create a dust hazard.
 - 4.8.7 Masons and other workers with dusty clothes shall remove their outer clothing or otherwise remove masonry-generated dust from their clothes prior to leaving the work area for breaks or end of work. Do not use high-pressure air to remove dust.

5.0 Records

- 5.1 The following documentation will be maintained.
 - 5.1.1 Training of flagmen/spotters
 - 5.1.2 Inspections of shoring equipment
 - 5.1.3 Air sampling logs for crystalline silica, as needed

6.0 Attachments

- 6.1 [S3AM-338-ATT1](#) [Concrete Products Health Effects](#)

1.0 Purpose and Scope

- 1.1 This procedure applies to all AECOM Americas based employees and operations where construction activities are being performed.
- 1.2 The purpose of this procedure is to confirm the safety of AECOM personnel during construction activities involving walking and working surfaces.

2.0 Terms and Definitions

- 2.1 None

3.0 References

- 3.1 S3AM-304-PR1 Fall Protection

4.0 Procedure

- 4.1 Roles and Responsibilities

- 4.1.1 **Managers**

- Responsible for the implementation of this procedure and compliance with local regulations.

- 4.1.2 **SH&E Managers**

- Provide guidance as to application of the procedure.

- 4.1.3 **Employees**

- Adhere to this procedure, apply appropriate precautions and work practices in their use of ladders and stairways.

- 4.2 Temporary Flooring

- 4.2.1 In buildings, or structures of skeleton steel construction, the permanent floor filling or the floor filling forms, except for temporary shaftway openings, will be installed as the erection progresses.

- 4.2.2 No more than one open floor is allowed under the floor where work is progressing. Install either a permanent or a temporary floor.

- 4.2.3 Cover the entire area with the temporary floor, except the required places for access to ladders and stairways and for hoisting purposes.

- 4.2.4 Planks will be not less than 2 inches thick (5 centimeters), full-size, and undressed. The planks shall be laid close together, supported on a solid bearing, and securely fastened to the framework of the structure.

- 4.2.5 Remove all loose objects lying on the planks before the planks are dismantled to prevent such objects from falling on persons below.

- 4.2.6 Conduct frequent and careful inspections of all temporary flooring and other false work to be sure it is always maintained in safe working condition.

- 4.2.7 Immediately report and correct all defective materials or unsafe conditions discovered by the workers.

- 4.2.8 Install a safety railing of ½-inch-diameter (1.25 centimeters) wire rope or equal, meeting local regulatory requirements, approximately 42 inches high (1.1 meters) around the periphery of all

temporary planked or temporary metal-decked floors or tier buildings and other multi-floored structures during structural steel assembly. Flag wire rope every 6 feet (1.8 meters).

- 4.2.9 Install and maintain safety nets wherever the potential fall distance exceeds two stories or 25 feet (7.6 meters) on buildings or structures not adaptable to temporary floors, where scaffolds are not used, and/or as required by local regulation.

4.3 Stairs and Stairwells

- 4.3.1 Industrial or construction (temporary or permanent) stairs shall be built in accordance with State, Provincial or Territorial regulations.
- 4.3.2 On all structures of two or more floors (20 feet [6 meters] or more) in height, stairways, ladders or ramps shall be provided to employees during the construction periods.
- 4.3.3 Construct all temporary stairs to safely support the anticipated load and according to jurisdictional requirements.
- 4.3.4 Construct temporary stairs so that the treads and risers are of uniform width and height in any one flight. This includes any foundation structures used as one or more treads of the stairs.
- 4.3.5 Temporary stairs shall have a landing not less than 30 inches (75 centimeters) in the direction of travel at every 12 feet (3.6 meters) of vertical rise.
- 4.3.6 Where doors or gates open directly on a stairway, provide a platform that extends at least 20 inches (50 centimetres) beyond the swing of the door.
- 4.3.7 Sufficient illumination on all stairways will be maintained, providing at least 5 foot (50 lux) candles of light on the steps. All lamps providing stairway illumination will be substantially guarded either mechanically or by location.
- 4.3.8 Stairway landings that are not enclosed will be considered as platforms, and shall be guarded with standard railings and toeboards.
- 4.3.9 Whenever temporary railings or enclosures are removed for the purpose of handling materials or the installation of other work, they shall be immediately replaced upon the completion of such work.
- 4.3.10 The wooden treads shall be free from protruding nails and splinters, and shall be replaced when any part of the tread is worn below the height of the nosing.
- 4.3.11 Before permitting foot traffic, stairways on which treads and/or landings are to be filled in later with concrete or other material will be fitted with temporary wooden treads laid in full width of the tread and landing to the height of the nosing, firmly fitted and secured in place.
 - Temporary treads and/or landings will be replaced when worn below the level of the metal nosing.
 - Metal landings shall be secured in place before filling.
- 4.3.12 Equip every flight of stairs having four or more risers with a handrail.
- 4.3.13 A stair railing will be of construction similar to a standard guardrail and free from protruding nails or splinters. The vertical height from the tread at the face of the riser to the top surface of the top rail shall meet the local jurisdictional requirements.
- 4.3.14 Stairways, until permanently enclosed, will be guarded on all open sides with stair railings.
 - Open sides of stairway landings, porches, balconies, and similar locations will be guarded with standard railings meeting jurisdictional requirements.
 - Closed stairways shall be equipped with a railing on at least one side (right preferred).
- 4.3.15 The top rail shall be a smooth surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The

ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard).

- 4.3.16 The uprights will be not less than 2 inches by 4 inches nominal (5 centimetres by 10.2 centimetres), spaced not more than 8 feet (2.4 meters) apart and properly anchored.
- 4.3.17 The rail cross section will be not less than 2 inches by 4 inches nominal (5 centimetres by 10.2 centimetres) or equivalent.
- 4.3.18 Railings and toe boards will be installed around stairwells.
- 4.3.19 Slippery conditions on stairways will be eliminated as soon as possible.
- 4.3.20 All parts of stairways, including the treads, approaches and landings, will be:
 - Free of hazardous projections, such as protruding nails, etc.
 - Kept clear of debris, loose material, and equipment not in use.
- 4.3.21 Spiral stairways will not be permitted except for special limited usage and secondary access situations where it is not practical to provide a conventional stairway.

4.4 Standard Railings

- 4.4.1 Standard railing or guardrails will consist of a top rail, an intermediate rail, upright supports, and toeboards meeting local regulatory requirements.
- 4.4.2 Confirm the upper surface of the top rail has a vertical height from the floor or platform that meets the jurisdictional requirements (e.g. California 42 inches to 45 inches [1067 millimetres to 1143 millimetres]). Requirements by jurisdiction vary from 35 ½ inches to 45 inches (900 millimetres to 1143 millimetres). The intermediate railing shall be midway between the floor or platform and the underside of the top rail.
- 4.4.3 Construct all railings in a substantial manner of wood, metal pipe, angle iron, or other metal shapes; railings shall be able to withstand, without failure, a force of at least 200 pounds (890 newtons) applied within 2 inches (5 centimetres) of the top edge, in any downward or outward direction, at any point along the top edge.
- 4.4.4 Space posts or uprights not more than 8 feet (2.4 meters) apart.

4.5 Wood Railings

- 4.5.1 The minimum the top rail and upright can be made of is 2 inch by 4 inch nominal (5 centimetres by 10 centimeters) stock; the intermediate rail of 1 inch by 6 inch nominal (2.5 centimetres by 15 centimeters) stock. The top rail shall be smooth surfaced throughout its entire length and free from splinters.
- 4.5.2 Light wood rails or scantlings resting on barrels, boxes, or other makeshift supports will not be set up or used as guardrails.
- 4.5.3 Construct all railings of good, sound material free from large or loose knots, with all stock smooth surfaced.

4.6 Pipe Railings

- 4.6.1 The post or upright support, top rail, and intermediate rail shall be of metal pipe at least 1 ½ inch (1.25 centimetres) inside diameter.

4.7 Structural Metal Railings

- 4.7.1 The post or upright support, top rail and intermediate rail will be of angle iron at least 2 inch by 2 inch by 3/8 inch (5 centimetres by 5 centimetres by 1 centimetre) or other metal shapes of equivalent bending strength.
- 4.7.2 The spacing of posts or uprights will not exceed 8 feet (2.4 meters).

4.8 Toeboards

- 4.8.1 Confirm the upper surface of the toeboard has a vertical height from the floor or platform to the top edge of the toeboard that meets the applicable jurisdictional requirements. Requirements vary from 3 ½ inches to 6 inches (90 millimetres to 150 millimetres) and may specify space restrictions between the floor or platform and the bottom edge of the toeboard (e.g., Mexico requires toeboards of a minimum height of 6 inches (150 mm) with the toeboard flush to the platform).
- 4.8.2 Where material is piled to such height that a standard toeboard does not provide protection, paneling or screening not greater than ½-inch (1.25 centimeters) wire mesh from floor to intermediate rail or to top rail shall be provided.

4.9 Floor and Wall Openings

- 4.9.1 Guard every floor opening, permanent or temporary, either with a standard railing and toeboard on all exposed sides (except at entrances to stairways), or a cover of sufficient strength to safely support any load. Said covering shall be secured in place and properly labelled to prevent accidental removal or displacement. While the cover is not in place, someone shall constantly attend such openings, and shall be protected by a portable closing rail, or by other effective means.
- 4.9.2 Guard wall openings from which there is a drop of more than 4 feet (1.2 meters), and the bottom of the opening is less than 3 feet (0.9 meters) above the working surface.
- 4.9.3 The guard shall be either a standard railing or toeboard, or a standard railing with an enclosing screen of solid construction, grills or slat work with openings of not more than 4 inches (10 centimeters) in width.

4.10 Open-Sided Floors, Platforms, and Runways

- 4.10.1 Guard every open-sided floor of 4 feet (1.2 meters) or more above the adjacent floor or ground level except for entrances to a ramp, stairway, or fixed ladder on all open sides with a standard railing and toeboard.
- 4.10.2 Wherever materials have to be regularly passed over the edge of the floor, a section of the railing may be made removable.
- 4.10.3 Guard every runway 4 feet (1.2 meters) or more above floor or ground level with a standard railing on all open sides. Wherever tools, machine parts, or materials are likely to be used on the runway, a toeboard will also be provided on each exposed side.
- 4.10.4 Every inclined runway, where erected for the use of workers, will be provided with cleats not more than 16 inches (40 centimeters) apart to prevent slipping and aid workers in maneuvering the incline.

4.11 Miscellaneous

- 4.11.1 Regardless of height, open-sided floors, walkways, platforms, runways, or any pathway used for a wheelbarrow, above or adjacent to dangerous equipment, plating or galvanizing tanks, degreasing units, or other secondary hazards, will be guarded with a standard railing and toeboard.
- 4.11.2 Caution shall be exercised while using crossovers on conveyor systems. The conveyor system shall be locked out and de-energized prior to use of the crossover unless other preventive measures have been established that provide an equal or greater degree of protection.

5.0 Records

- 5.1 None

6.0 Attachments

- 6.1 None

Attachment 3 – Site Safety and Health Plan

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
APP	Accident Prevention Plan
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
EPA	Environmental Protection Agency
HAZWOPER	Hazardous Waste Operation and Emergency Response
JSA	Pre-Job Hazard Assessment / Job Safety Analysis
LEL	lower explosive limit
OBZ	operator breathing zone
OSHA	Occupational Safety and Health Administration
PID	photoionization detector
PM	Project Manager
POL	petroleum, oil, and lubricants
PPE	personal protective equipment
ppm	parts per million
SDS	Safety Data Sheet
SHM	Safety and Health Manager
SOP	standard operating procedure
SSHP	Site Safety and Health Plan
SSR	Subcontractor's Safety Representative
THA	Task Hazard Analysis
USACE	United States Army Corps of Engineers
VOC	volatile organic compound
WP	Work Plan

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SITE SAFETY AND HEALTH PLAN
PFC/PFAS SAMPLING AND MITIGATION

Contract Number: W912DY-16-D-0026
Task Order W9128F18F0276

Preparation Date: 1 November 2018

Plan Preparer

Dennis Day – (402) 321-2761
Safety and Health Manager

Date

Plan Approval

Denny Jorgenson – (402) 952-2546
Task Order Program Manager

Date

Plan Concurrence

Bill Wemmert – (303) 740-3928
PFAS Mitigation Design Project Manager

Date

This Site Safety and Health Plan (SSHP) is valid for this specific project only, as described in **Section 1** of the Accident Prevention Plan (APP). This SSHP is not to be used for other projects or subsequent phases of this project without the written approval of the Safety and Health Manager (SHM). **A copy of this plan is to be maintained at the site at all times during the performance of field activities.**

The general information, which includes site background, responsibilities and lines of authority, general site control, and general site safety procedures, is presented in **Section 2** and **Section 4** of the APP.

2.1 PROJECT HAZARD ANALYSIS

Project Hazard Analysis was completed for work that will be conducted as part of the project requirements. These tasks include: utility clearance, site inspection, excavation/trenching, heavy equipment operation, traffic control, directional boring, conveyance line installation, conveyance line testing and cleaning, water treatment facility building construction, water treatment facility process and instrumentation installation, water treatment facility startup and operation, treatment system groundwater operation.

Project hazards include biological, chemical and physical. An Activity Hazard Analysis (AHA) has been developed for the above tasks that present potential hazards. If additional tasks are identified during the period of performance, additional AHAs will be completed. The AHAs define the activity being performed, the sequence of work, specific safety and health hazards anticipated, control measures, equipment, inspection requirements, training requirements, and the competent person in charge of that phase of work. AHAs for the tasks can be found in Attachment 1 of the APP. Additional information regarding site history and the scope of the field activities are presented in the Section 2 of the APP.

2.2 BIOLOGICAL HAZARDS

Biological hazards and mitigations are presented in Section 10.16 of the APP.

2.3 CHEMICAL HAZARDS

Chemical hazards in general and the Hazard Communication Program are discussed in Section 10.16 of the APP.

The Hazard Communication Program provides personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. The following Procedures, related to hazard communication, are included in Attachment 2 of the APP.

- S3NA-115 - Hazardous Materials Communication
- S3NA-117 - Hazardous Waste Operations
- S3NA-125 - Corrosive and Reactive Materials

Exposure to chemical hazards can present a risk of serious injury. This SSHP provides the basics to avoiding occupational exposure to chemical hazards through the use of personal protective equipment (PPE). From an occupational health standpoint, potential exposure to site personnel will be only for a short period of time (intermittent for several days). However, new investigations have the potential for exposure to elevated levels of unknown contaminants.

Skin contact with potentially contaminated materials will be minimized by the use of administrative practices and PPE. Inhalation of vapors or particulates during the site activities will be minimized by use of engineering controls. Respiratory protection will be used if permissible exposure limits are exceeded. Air monitoring with a photoionization detector (PID) will be completed in the field to determine levels of respiratory protection required. Ingestion of contaminated materials will be minimized by the use of appropriate personal hygiene procedures during decontamination (i.e., thoroughly washing face and hands with soap and water after leaving the work area and prior to eating or drinking).

2.3.1 Potential On-Site Contaminants

Chemical hazards suspected to potentially be on site are discussed in Section 7.7 of the APP.

2.3.2 Chemicals Brought On-Site

Chemicals may be used during sample testing with field kits during environmental responses for elementary chemical neutralization of waste products or for POL soil land farming. A chemical inventory will be developed (including information on the approximate quantities and storage locations – for emergency response purposes). All chemical products brought on-site will be properly labeled and a copy for each Safety Data Sheet (SDS) will be maintained on-site.

The following general housekeeping techniques will be used to minimize exposure to chemicals via all pathways:

- Where possible, personnel will remain upwind of contaminated areas.
- Contaminated materials will be stored in a designated area and will be placed in bags or Fine drums as soon as possible.
- If needed, samples will be collected in suitable containers in a controlled manner.
- Handling of potentially contaminated materials will be kept to a minimum.

If handling of potentially contaminated soil and/or water is necessary to complete work, the exposure to this contamination will be controlled by the correct use of appropriate PPE and by strict personal hygiene.

The correct use of PPE is essential, for further information See **Section 4**.

2.3.3 Hazard Communication Materials

Materials that are considered hazardous under the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard (29 Code of Federal Regulations [CFR] 1910.1200) may be present during this project. In accordance with the Hazard Communication Program, the SDSs for the hazardous materials will be maintained on-site. The

Safety Manager will make copies of these SDSs available to all personnel, including subcontractors on this project.

2.4 PHYSICAL HAZARDS

Physical hazards and mitigations are presented in **Section 7.6** of the APP and in the AHAs.

URS will have site safety and health oversight and coordination responsibilities for all project personnel; and each subcontractor will be held accountable for the safe and healthful performance of work by each of their employees (S3NA-213 - Subcontractor Management), subcontractors, or support personnel who may enter the site. The subcontractor will strictly adhere to the provisions of the APP, along with the applicable regulations issued by governmental entities.

Changing and/or unanticipated site conditions may require modification of this site safety plan in order to maintain a safe and healthful work environment. Any proposed changes to this plan will be reviewed and approved by the PM and SHM. Final approval of all changes will require the United States Army Corps of Engineers (USACE) Authorized Representative to approve the changes and provide written documentation that the changes have been accepted.

The contractor is providing a copy of the APP and SSHP to each subcontractor to fulfill its obligation under 29 CFR 1910.120(b) to inform subcontractors of site hazards. Each subcontractor will provide their own APP that complies with 29 CFR 1910.120 and addresses the activities of its employees relative to this project. In addition, each subcontractor will provide training certifications for 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) and 8-hour HAZWOPER refresher training for personnel involved with field activities.

2.5 PROJECT PERSONNEL

See Section 4 of the APP for project personnel requirements and responsibilities.

2.6 SAFETY PERSONNEL

Safety personnel responsibilities are discussed in Section 4.2 of the APP. Requirements of the Subcontractor's Safety Representative are discussed in Section 5.2 of the APP.

Training is addressed in Section 6 of the APP and Training Documentation in **Section 15.4** of this SSHP.

Procedures for use and selection of PPE are located in the approved S3NA-208 - Personal Protective Equipment in Attachment 2 of the APP. The level of protection worn by site personnel will be enforced by the SSHO.

The level of PPE and upgrade requirements are provided in **Table 4-1**. Initial minimum PPE requirements for each task are outlined in the AHA presented in Attachment 1 of the APP. Downgrade of PPE will be at the discretion of the SSHO, and will be based on the task being performed, air monitoring results, and applicable regulations.

4.1 LEVEL D PPE

Level D protection is the minimum level of PPE that will be worn by field personnel. Level D offers no protection against the inhalation hazards of airborne contaminants. Level D ensembles are not airtight; therefore, dermal exposure to vapors and liquids is possible. This level is not authorized when an airborne contaminant is present above permissible exposure limits. Level D PPE will be worn for activities as specified in **Table 5-1**, and at a minimum will consist of the following:

- Work clothes
- Safety-toe work boots
- Safety glasses
- Goggles (when required or desired)
- Hard hat (when overhead hazards exist)
- Leather work gloves
- Hearing protection (if required)

4.2 MODIFIED LEVEL D

Modified Level D PPE offers protection from casual contact with contaminated soils and materials, but will not be worn when there is potential for airborne exposure to hazardous substances. Modified Level D PPE will be worn for activities specified in **Table 5-1**, and at a minimum will consist of the following:

- Work clothes
- Safety-toe work boots
- Chemical-resistant boot covers, TAP (M2A1) (as required)
- Safety glasses with side shields
- Goggles (as required)

- Hard hat (when overhead hazards exist)
- Leather work gloves
- Nitrile gloves (when sampling)
- Hearing protection (as required)
- Respiratory protection, North 54501(slung). If used, the level of protection will change to Level C.
- Tychem[®] or Tyvek F suit

4.3 LEVEL C PPE

Level C PPE offers protection against the inhalation hazards of airborne contaminants by the use of either air filtration or chemical cartridges or combinations of both. Level C ensembles are not airtight; therefore, dermal exposure to vapors and liquids is possible. Level C protection can be used when the chemical hazards do not pose acute toxic hazards via dermal contact or when no possibility of dermal contact exists and when contaminants that can be sensed (either by smell or breathing resistance when filters alone are used) are present below permissible exposure limits. Level C PPE will be worn for activities as specified in **Table 5-1**, and at a minimum will consist of the following:

- NIOSH approved respirator for chemical, biological, radiological, and nuclear (CBRN) environments, North 54501
- Tychem[®] F or Tyvek F suit (with hood), all borders double taped
- Inner gloves: Nitrile gloves or surgical gloves
- Outer gloves: Non-standard chemical protective butyl rubber gloves, TAP (M3)
- Leather work gloves (as required)
- Approved chemical-resistant rubber safety boots (safety toe), TAP (M2A1)
- Chemical-resistant boot covers
- Hard hat (when overhead hazards exist)
- Hearing protection (as required)

Table 4-1
Levels of Personal Protective Equipment (PPE)

Level of Protection	Criteria for Use	Upgrade Criteria
Level D	Required for all work outside of EZs.	If unanticipated chemical hazards are encountered
Modified Level D	Initial level of protection for all work in EZ with suspected hazardous waste contamination	Air monitoring detects other chemicals above action levels or Presence of strange odor or Discovery of discolored soils
Level C	Air monitoring detects other chemicals above action levels and No chemical splash hazards	Chemical splash or hazard exists or Air monitoring detects industrial chemicals above action level for Level B or Level A

Notes:

EZ = Exclusion Zone

N/A = Not Applicable

Site personnel are required to participate in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of Training Certificates and Statements of Medical Program Participation for on-site personnel will be maintained on-site. Detailed information regarding medical screening and surveillance is provided in S3NA-128 - Medical Screening and Surveillance (Attachment 2 of the APP).

5.1 HAZWOPER TRAINING AND MEDICAL SURVEILLANCE

All URS and subcontractor personnel working within the EZ of site intrusive activities will have met the requirements of 29 CFR 1910.120(e), including:

- Forty hours of initial off-site training or its recognized equivalent
- Eight hours of annual refresher training for all personnel (as required)
- Eight hours of supervisor training for personnel serving as SSHO or supervising or managing on-site work activities
- Three days of work activity under the supervision of a trained and experienced HAZWOPER site supervisor. This work activity must be documented for all HAZWOPER site supervisors.
- At all times, at least two of the fieldworkers will have current first aid and cardiopulmonary resuscitation (CPR) certification.

All URS site personnel are participating in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f). Current copies of training certificates and statements of medical program participation for all personnel are maintained by the local offices and at the site. A list of site personnel and their training certificates will be provided prior to the start of fieldwork.

5.2 HAZWOPER MEDICAL SURVEILLANCE

Site personnel are required to participate in medical surveillance programs that meet the requirements of 29 CFR 1910.120(f) and 1926.65 (including blood lead/zinc photoporphyrin [ZPP] prior to working on the site). Current copies of training certificates and statements of medical program participation for on-site personnel will be maintained on-site. Detailed information regarding medical screening and surveillance is provided in S3AM-128-PR1 (Attachment 2 of the APP).

5.2.1 Initial Blood Analysis Requirements

Employees must receive an initial blood lead/ZPP analysis when assigned to work in the EZ of a lead site. The blood lead/ZPP should be taken prior to mobilization. If this option is not available, the blood lead/ZPP analysis must occur within 5 days of the employee arriving on-site.

This analysis applies to all employees working in the EZ, regardless of the length of their assignment on the project.

It is the PM's responsibility to ensure that workers complete their blood sampling prior to or within 5 days of mobilization.

5.2.2 Exit Blood Analysis Requirements

At the end of a worker's assignment in the EZ of a lead site, an exit blood lead/ZPP analysis must be run unless the worker has been on-site less than 30 days and working in an area where the Action Level (as documented by personnel air monitoring data specific to the site), has not been achieved. If circumstances exist where there is no proof that the worker was working in conditions below the Action Level, an exit blood lead/ZPP analysis must be performed for that worker.

5.2.3 Blood Lead/ZPP and Air Sampling Data Management

All data for blood lead/ZPP and air sampling are considered confidential and will be maintained in personnel files. For project management purposes, results without personnel identifiers will be used.

5.3 BEHAVIOR-BASED SAFETY

Most accidents are due to unsafe behavior, and behavior changes may be made that significantly reduce accident risk. URS employees and subcontractors are expected to value safety and be responsible for their safety as well as the safety of others. The SSHO is expected to provide clear safety expectations and provide positive and negative feedback for safe and unsafe behavior. Peers are expected to intervene upon an unsafe behavior and provide positive feedback for safe behavior.

The SSHO will maintain S3NA-007-FM1 - Behavior Based Safety Checklist or a similar form modified for task specific operations. Details of Behavior-Based Safety can be found in S3NA-007 – Behavior Based Safety (Attachment 2 of the APP).

5.4 INITIAL SITE SAFETY BRIEFING

Prior to the start of operations at the site, and for every new employee assigned to perform work at the site, the SSHO will conduct a site safety briefing, which will include all personnel involved in site operations. At this meeting, the SSHO will discuss:

1. Contents of this SSHP
2. Types of physical and chemical hazards (extent and concentrations) at the site and means for minimizing exposure to hazards

3. Health effects of chemicals hazards
4. The type of monitoring that will be performed
5. Action levels for upgrade and downgrade of PPE
6. Personal protective equipment that will be used
7. Site-specific respiratory protection requirements
8. Decontamination protocols
9. Site control measures, including safe operating practices and communication
10. Location and use of emergency equipment (first aid kit, fire extinguishers)
11. Evacuation signals and procedures
12. Verification that the health and safety plan has been reviewed
13. Emergency Contacts
14. Route to the hospital

All site personnel, including subcontractor personnel, are to attend the briefing, review the SSHP and sign the Personnel Acknowledgement Form in Attachment 4 of the APP; copies of these forms will be maintained in the project file.

5.5 DAILY SAFETY MEETING

Daily Tailgate Safety Briefings will be conducted each morning, and whenever there is a change in task or significant change in task location. All personnel will be required to sign the Daily AHA form included in Attachment 4 of the APP for each day they are on-site.

5.6 DAILY SAFETY TASK ANALYSIS

Prior to initiating work each day, the SSHO will perform a Daily Safety Task Analysis, recording the results on the Daily S3NA-209-FM6 – Task Hazard Assessment form (included in Attachment 4 of the APP). The current conditions will be evaluated compared to conditions anticipated and hazards found in the applicable AHA for the activity (i.e., job or task) to be performed that day. If the current AHA does not adequately address unanticipated hazards, the AHA must be updated and approved by the SSHO and the RHSM.

5.7 4 SIGHT PROGRAM

The major objective of the 4sight program is to make safe behavior the first consideration among URS employees, our subcontractor and our clients. This simple tool ensures that, before any specific task is completed, employees consider safe behavior thoroughly by asking four questions:

- What am I about to do?
- What could go wrong?
- What could be done to make the task safer?
- What have I done to communicate the hazards?

Keep these four questions in mind in order to put your safety and the safety of your colleagues and contractors at the forefront. 4sight was developed to be used by URS employees every day for any task. 4sight is used as a last-minute safety assessment to identify hazards before they become incidents.

5.8 LEAD AWARENESS TRAINING

Although lead exposure above the action level is not anticipated, employees will require documented training in the following:

- The contents of lead in construction standard, including appendices (19 CFR 1926.62)
- The nature of operations that could result in exposure to lead above the action level
- The purpose, proper selection, fitting, use and limitations of respirators
- The purpose and description of the URS Medical Surveillance Program and removal protection, including information concerning the adverse health effects associated with excessive exposure to lead
- The engineering controls and work practices associated with the employee's job assignment, including training of employees on following relevant good work practices
- The content of any Lead Compliance Plan (SSHP) and the location of regulated areas (EZ) in effect
- Instructions to employees that chelating agents should not be routinely used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician
- The employee's right to access records

6.1 HEAT AND COLD STRESS, NOISE, CHEMICAL, AND RADIATION EXPOSURE

Heat and cold stress, noise, chemical, and radiation exposure may be encountered during the project. Heat and cold stress are addressed in Section 10 of the APP. Noise levels will not be monitored during field activities, but URS personnel will use hearing protection when appropriate (i.e., during heavy equipment use). Exposure monitoring and air sampling will be conducted in order to continuously evaluate effectiveness and level of PPE required for field activities. Monitoring also assists in evaluating employee exposure to hazardous substances encountered during field activities.

6.2 CHEMICAL EXPOSURE MONITORING

No exposure to airborne contaminants or chemicals is anticipated during this project. If monitoring for airborne contaminants and/or chemicals is determined to be necessary based on new information, a plan will be written to address the hazard and it will be completed as needed.

6.3 SITE MONITORING STRATEGY AND APPROACH

Based on the field activities anticipated to be completed as part of this project (mainly, excavation/trenching), monitoring and control of dust generated will be required initially. If monitoring and control data show that dust levels are not exceeding applicable thresholds, monitoring may be discontinued.

6.4 COMBUSTIBLE GAS MONITORING

This section is not applicable.

6.5 RADIATION MONITORING

This section is not applicable.

Heat and cold stress are discussed in **Section 10.24** and **10.25** of the APP.

Standard Operation Procedures (SOPs) for field activities can be found in **Appendix C** of the Quality Assurance Project Plan.

8.1 SITE RULES/PROHIBITIONS

Site rules/prohibitions are covered in S3NA-013 - Housekeeping (Attachment 2 of the APP).

8.2 WORK PERMIT REQUIREMENTS

This section is not applicable.

8.3 MATERIAL HANDLING PROCEDURES

URS will handle hazardous materials in accordance with the APP and this SSHP.

8.4 DRUM/CONTAINER/TANK HANDLING

If contaminated soil, sediment, and/or water are required to be containerized, URS will procure 55-gallon drums, sealed CONEX boxes, or dump/transport trucks to store and transport the materials. The soil, sediment, and/or water will be shipped in accordance with applicable regulations and URS SOPs. Required hazardous waste manifests will be prepared by an appropriately trained and certified shipping agent or specialist.

The purpose of site control is to protect the public from inadvertently coming into contact with site hazards and to protect site personnel from being impacted by hazards. Activities will be conducted in a secure and restricted access location. Site control will be accomplished through the daily safety brief. All site personnel will be informed of each day's activities and associated site control requirements. An exclusion zone (EZ) will be maintained visually and only authorized site workers will be allowed within 20 feet of intrusive activities. The support zone will be located outside the 20 foot perimeter around the intrusive activity. The contamination reduction zone will be the between the support zone and the intrusive activity.

10.1 CONTAMINATION PREVENTION

During the use of hazardous chemicals or when potentially contaminated materials are encountered, contamination prevention protocols will be implemented. Procedures for contamination prevention for personnel include:

- Do not carry or use gum, chewing tobacco, or cosmetics in the CRZ or SZ.
- Do not smoke or use tobacco products onsite
- Stay upwind of the contaminated area.
- Do not handle or touch contaminated materials directly.
- Make sure that all PPE is free of cuts or tears prior to donning.
- Fasten all closures on suits, covering with tape if necessary.
- Take special care to protect any skin injuries. If open wounds exist on hands or forearms, handling chemicals or contaminated materials should be restricted or eliminated.

10.2 DECONTAMINATION PROCEDURES

Personnel decontamination will be required for personnel conducting environmental activities. Personnel will avoid contact with potentially contaminated soil/sediment/water and will take precautions to prevent being splashed with liquid chemical products or potentially contaminated water. During soil/sediment/water sampling activities, personnel will also avoid contact with potentially contaminated equipment, media, chemical vapors, dusts, fumes, and mists. PPE, including gloves, boots, and clothing; will be used to limit exposure to contamination.

Section 4 of the SSHP contains additional information regarding PPE levels.

Either decontamination or disposal of PPE will be used.

All workers will wash hands and any other soiled body parts (arms, faces) prior to leaving the CRZ. Potable water, liquid soap, and disposable towels will be provided in the CRZ and will be used for washing prior to leaving the CRZ.

10.3 RESPIRATOR USE

This section is not applicable.

10.4 DECONTAMINATION – MEDICAL EMERGENCIES

Exposure to chemicals may require that decontamination occur both as an initial first aid protocol (to limit chemical effects) and also to allow transport to medical facilities off site.

10.5 SANITATION

Sanitation is discussed in Section 10.7 of the APP.

11.1 EQUIPMENT DECONTAMINATION

When all work activities have been completed, contaminated tools used by site personnel will be either appropriately decontaminated or properly disposed. All tools will be constructed of non-porous, non-absorbent materials.

Tools and equipment will be decontaminated using water and phosphate-free detergent (Alconox or equivalent) while using a scrub brush to remove contamination. The tools will be rinsed with disinfected, non-potable water and dried by air or with paper towels. Tools will be stored in clean plastic bags or in storage areas approved by USACE.

11.2 DECONTAMINATION PROCEDURES IN THE EXCLUSION ZONE

Decontamination water may be containerized during environmental or spill response activities. If necessary, decontamination water will be sealed in Department of Transportation approved containers at the work sites and later transferred to a designated temporary storage area designated by USACE COR. URS will transfer the storage containers between the work site and the designated temporary storage area.

Each container will be labeled as follows:

- Installation identification
- Site name and number
- Classification of waste
- Type of waste
- Source of waste
- Date(s) of accumulation
- Name and phone number of site contact.

URS will dispose of decontamination water in accordance with Colorado policies and regulations.

A supply of emergency PPE and first aid equipment will be maintained in sufficient quantities to ensure an adequate supply for emergency response. All emergency equipment will be fully stocked and readily accessible as needed. Refer to S3NA-012-FM1 – First Aid Kit AED Inventory and Inspection. (Attachment 4 of the APP). The following emergency supplies will be available and maintained in a vehicle used by each field team:

- Industrial first-aid kit (one 16-unit kit that complies with American National Standards Institute Z308A for every 25 persons or less) with alcohol swabs removed
- Bloodborne pathogen precaution kit with CPR mouth shield
- Instant cold packs
- Portable emergency eye wash and drenching station
- Fire extinguishers
- Face shields
- Nitrile gloves
- Spill control/absorption supplies
- Soap or waterless hand cleaner and towels;
- American Red Cross First Aid and CPR instruction manuals
- Multiple sizes of bandages
- Burn blanket

Emergency procedures are discussed in Section 10.3 of the APP.

13.1 INCIDENT COMMAND SYSTEM

Paragraph 1910.120(q)(3)(ii) requires the implementation of an Incident Command System (ICS). The ICS is an organized approach to effectively control and manage operations at an emergency incident. The individual in charge of the ICS is the senior official responding to the incident. The ICS is not much different than the "command post" approach used for many years by the fire service. During large complex fires involving several companies and many pieces of apparatus, a command post would be established. This enabled one individual to be in charge of managing the incident, rather than having several officers from different companies making separate, and sometimes conflicting, decisions. The individual in charge of the command post would delegate responsibility for performing various tasks to subordinate officers. Additionally, all communications were routed through the command post to reduce the number of radio transmissions and eliminate confusion. However, strategy, tactics, and all decisions were made by one individual.

The ICS is a very similar system, except it is implemented for emergency response to all incidents, both large and small, that involve hazardous substances.

For a small incident, the individual in charge of the ICS may perform many tasks of the ICS. The SSHO will be the individual in charge. There may not be any, or little, delegation of tasks to subordinates. For example, in response to a small incident, the individual in charge of the ICS, in addition to normal command activities, may become the safety officer and may designate only one employee (with proper equipment) as a backup to provide assistance if needed. OSHA does recommend, however, that at least two employees be designated as back-up personnel since the assistance needed may include rescue.

To illustrate the operation of the ICS, the following scenario might develop during a small incident, such as an overturned tank truck with a small leak of flammable liquid.

The SSHO would implement and take command of the ICS. The SSHO would size-up the incident and determine if additional personnel and apparatus were necessary; would determine what actions to take to control the leak; and determine the proper level of personal protective equipment. If additional assistance is not needed, the individual in charge of the ICS would implement actions to stop and control the leak using the fewest number of personnel that can effectively accomplish the tasks. The individual in charge of the ICS then would designate himself as the safety officer and two other employees as a back-up in case rescue may become necessary. In this scenario, decontamination procedures would not be necessary.

A large complex incident may require many employees and difficult, time-consuming efforts to control. In these situations, the individual in charge of the ICS will want to delegate different tasks to subordinates in order to maintain a span of control that will keep the number of subordinates, which are reporting, to a manageable level.

Delegation of task at large incidents may be by location, where the incident scene is divided into sectors, and subordinate officers coordinate activities within the sector that they have been assigned.

Delegation of tasks can also be by function. Some of the functions that the individual in charge of the ICS may want to delegate at a large incident are: medical services; evacuation; water supply; resources (equipment, apparatus); media relations; safety; and, site control (integrate activities with police for crowd and traffic control). Also for a large incident, the individual in charge of the ICS will designate several employees as back-up personnel; and a number of safety officers to monitor conditions and recommend safety precautions.

Therefore, no matter what size or complexity an incident may be, by implementing an ICS there will be one individual in charge who makes the decisions and gives directions; and, all actions, and communications are coordinated through one central point of command. Such a system should reduce confusion, improve safety, organize and coordinate actions, and should facilitate effective management of the incident.

Confined space entry is not anticipated, however if confined space entry is required during field activities, see Section 10.64 and 10.65 of the APP for confined space entry procedures.

15.1 REQUIRED DOCUMENTATION

The Site Manager and the SSHO are responsible for site recordkeeping. All URS personnel and URS subcontractors will review the SSHP and sign the Personnel Acknowledgement, daily site safety briefings, and any “toolbox” training topics. Copies of these forms will be maintained in the on-site project file.

All instrument readings and calibrations, PPE use and changes, health and safety-related issues, and deviations from or problems with this SSHP will be recorded in the Field Logbook.

Maintain an Inventory of Hazardous Materials and SDSs for all hazardous materials present on-site, including materials brought on-site by subcontractors.

In addition the following safety records will be maintained in the on-site project files. These records must be available in the event of an internal or external compliance audit.

- Fit Test Records
- HAZWOPER and Safety Training Records
- Medical Clearance Record
- S3NA-012-FM1 – First Aid Kit AED Inventory and Inspection – monthly inspection documentation
- Site Visitors Log
- S3NA-007-FM1 - Behavior-Based Safety Checklist
- Medical Emergency Contact Sheet
- OSHA Form 300A, Summary of Work Related Injuries and Illnesses
- USACE Form 3394 Version 2
- S3NA-209-FM6 – Task Hazard Assessment
- Any other site-specific permits, training records, or documentation

15.2 BEHAVIOR-BASED SAFETY

Most accidents are due to unsafe behavior, and behavior changes can be made that significantly reduce accident risk. Project team personnel and subcontractors are expected to value safety and be responsible for their safety as well as the safety of others. The SSHO is expected to provide clear safety expectations and positive and negative feedback for safe and unsafe behavior. Peers are expected to intervene upon an unsafe behavior and provide positive feedback for safe behavior.

The SSHO will maintain Form S3NA-007-FM1 - Behavior-Based Safety Checklist. Details of Behavior-Based Safety can be found in S3NA-007 – Behavior-Based Safety (Attachment 2 of the APP).

15.3 SITE SURVEILLANCE

Workers will continuously monitor site conditions and their work efforts; and will notify the Site Manager or the SSHO if any unforeseen hazard becomes evident during field activities. The Site Manager or SSHO will communicate with on-site government representatives and determine if field activities can be continued in a safe manner.

15.4 TRAINING LOGS

Training logs will include initial site-specific safety training, daily safety briefings, weekly “toolbox” topic training, and visitor training. A record of the training will be documented on a training log, which will include the following information:

- The date
- Employee’s name (attendance check)
- Time allocation in training session
- Training topic(s)
- Trainer(s) signature

15.5 FIELD LOGBOOK

The SSHO will maintain a Field Logbook on-site in accordance with standard URS procedures. Complete and detailed documentation of site activities will be very important. The following information will be recorded on a daily basis:

- Site conditions (e.g., weather)
- Activities being performed
- Log of photographs taken
- Personnel on-site
- Site visitors
- Incidents, accident, and near misses

15.6 INCIDENT REPORTS

15.6.1 USACE Engineering Form 3394 Version 2

The SSHO will report all incidents using USACE Engineering Form ENG 3394 Version 2 the Accident Investigation Form, all injuries to project team workers and subcontractors that result in an OSHA recordable incident, and all property/equipment damage greater than \$2,000. The PM will verbally notify the USACE Authorized Representative of an incident within 24 hours, and a written report will be submitted on USACE Engineering Form ENG 3394 Version 2.

Information will include contractor/subcontractor name; contract title; type of contract; name of activity, installation, or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known; and brief description of accident (to include type of construction equipment used, PPE used). The conditions and evidence will be preserved at the accident site until the government investigation team arrives on site and a government investigation is completed.

15.6.2 Reporting

Details of incident reporting are presented in Section 9 of the APP.

Code of Federal Regulations, Hazardous Waste Operation and Emergency Response, Title 29, Sec. 1910.129







USACE. 2014. Safety and Health Requirements Manual, EM 385-1-1. 30 November.

Attachment 4 – Safety Forms

United States Army Corps of Engineers Accident Investigation Report (ENG Form 3394)

(For safety staff only)	REPORT NO.	EROC CODE	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT For use of this form, see Help Menu and USACE Supplement to AR 385-40 The proponent agency is CESO		REQUIREMENT CONTROL SYMBOL: CEEC-S-8 (R2)
	1. ACCIDENT CLASSIFICATION				
PERSONNEL CLASSIFICATION		INJURY/ILLNESS/FATAL		PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED
GOVERNMENT <input type="checkbox"/> CIVILIAN <input type="checkbox"/> MILITARY		<input type="checkbox"/>		<input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER	<input type="checkbox"/>
<input type="checkbox"/> CONTRACTOR		<input type="checkbox"/>		<input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER	<input type="checkbox"/>
<input type="checkbox"/> PUBLIC		<input type="checkbox"/> FATAL <input type="checkbox"/> OTHER		<div style="border: 1px solid black; height: 20px; width: 100%;"></div>	
2. PERSONAL DATA					
a. NAME (Last, First MI.)		b. AGE	c. SEX		d. SOCIAL SECURITY NUMBER
			<input type="checkbox"/> MALE <input type="checkbox"/> FEMALE		
f. JOB SERIES/TITLE		g. DUTY STATUS AT TIME OF ACCIDENT		h. EMPLOYMENT STATUS AT TIME OF ACCIDENT	
		<input type="checkbox"/> ON DUTY <input type="checkbox"/> TDY		<input type="checkbox"/> ARMY ACTIVE <input type="checkbox"/> ARMY RESERVE <input type="checkbox"/> VOLUNTEER	
		<input type="checkbox"/> OFF DUTY		<input type="checkbox"/> PERMANENT <input type="checkbox"/> FOREIGN NATIONAL <input type="checkbox"/> SEASONAL	
				<input type="checkbox"/> TEMPORARY <input type="checkbox"/> STUDENT	
		<input type="checkbox"/> OTHER (Specify)		<input type="checkbox"/> OTHER (Specify)	
3. GENERAL INFORMATION					
a. DATE OF ACCIDENT (YYYYMMDD)		b. TIME OF ACCIDENT (Military Time)		c. EXACT LOCATION OF ACCIDENT	
e. CONTRACT NUMBER		f. TYPE OF CONTRACT		g. HAZARDOUS/TOXIC WASTE ACTIVITY	
<input type="checkbox"/> CIVIL WORKS <input type="checkbox"/> MILITARY <input type="checkbox"/> OTHER (Specify)		<input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> SERVICE <input type="checkbox"/> A/E <input type="checkbox"/> DREDGE <input type="checkbox"/> OTHER (Specify)		<input type="checkbox"/> SUPERFUND <input type="checkbox"/> DERP <input type="checkbox"/> IRP <input type="checkbox"/> OTHER (Specify)	
4. CONSTRUCTION ACTIVITIES ONLY (Fill in line and corresponding code number in box from list - see help menu)					
a. CONSTRUCTION ACTIVITY (CODE)			b. TYPE OF CONSTRUCTION EQUIPMENT (CODE)		
<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>			<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>		
5. INJURY/ILLNESS INFORMATION (Include name on line and corresponding code number in box for items e, f & g - see help menu)					
a. SEVERITY OF ILLNESS/INJURY (CODE)			b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY
<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>					
e. BODY PART AFFECTED (CODE)			g. TYPE AND SOURCE OF INJURY/ILLNESS (CODE)		
PRIMARY <div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>			TYPE <div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>		
SECONDARY <div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>			<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>		
f. NATURE OF ILLNESS / INJURY (CODE)			SOURCE		
<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>			<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>		
6. PUBLIC FATALITY (Fill in line and correspondence code number in box - see help menu)					
a. ACTIVITY AT TIME OF ACCIDENT (CODE)			b. PERSONAL FLOTATION DEVICE USED?		
<div style="border: 1px solid black; padding: 2px;"> <div style="border-bottom: 1px solid black; height: 15px; width: 100%;"></div> </div>			<input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A		

7. MOTOR VEHICLE ACCIDENT						
a. TYPE OF VEHICLE		b. TYPE OF COLLISION		c. SEAT BELTS	USED	NOT USED
<input type="checkbox"/> PICKUP/VAN <input type="checkbox"/> AUTOMOBILE <input type="checkbox"/> TRUCK <input type="checkbox"/> OTHER (Specify) _____		<input type="checkbox"/> SIDE SWIPE <input type="checkbox"/> HEAD ON <input type="checkbox"/> REAR END <input type="checkbox"/> BROADSIDE <input type="checkbox"/> ROLL OVER <input type="checkbox"/> BACKING <input type="checkbox"/> OTHER (Specify) _____		(1) FRONT SEAT	<input type="checkbox"/>	<input type="checkbox"/>
				(2) REAR SEAT	<input type="checkbox"/>	<input type="checkbox"/>
8. PROPERTY MATERIAL INVOLVED						
a. NAME OF ITEM		b. OWNERSHIP		c. AMOUNT OF DAMAGE		
(1) _____		_____		_____		
(2) _____		_____		_____		
(3) _____		_____		_____		
9. VESSEL/FLOATING PLANT ACCIDENT (Fill in line and correspondence code number in box from list - see help menu)						
a. ACTIVITY AT TIME OF ACCIDENT		(CODE)		a. ACTIVITY AT TIME OF ACCIDENT		
_____		# _____		_____		
10. ACCIDENT DESCRIPTION (Use additional paper, if necessary, see attached page 4.)						
11. CAUSAL FACTOR(s) (Read instructions before completing)						
a. (Explain YES answers in item 13)						
DESIGN: Was design of facility, workplace or equipment a factor?					YES	NO
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?					<input type="checkbox"/>	<input type="checkbox"/>
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?					<input type="checkbox"/>	<input type="checkbox"/>
OPERATING PROCEDURES: Were operating procedures a factor?					<input type="checkbox"/>	<input type="checkbox"/>
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?					<input type="checkbox"/>	<input type="checkbox"/>
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?					<input type="checkbox"/>	<input type="checkbox"/>
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?					<input type="checkbox"/>	<input type="checkbox"/>
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?					<input type="checkbox"/>	<input type="checkbox"/>
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?					<input type="checkbox"/>	<input type="checkbox"/>
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?					<input type="checkbox"/>	<input type="checkbox"/>
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?					<input type="checkbox"/>	<input type="checkbox"/>
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident?					<input type="checkbox"/>	<input type="checkbox"/>
b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT? (If yes, attach a copy.)						
					<input type="checkbox"/>	<input type="checkbox"/>
12. TRAINING						
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?		b. TYPE OF TRAINING		c. DATE OF MOST RECENT FORMAL TRAINING (YYYYMMDD)		
<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> CLASSROOM <input type="checkbox"/> ON JOB		_____		
13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES (See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)						
a. DIRECT CAUSE(s) (Attach additional sheets as needed, See page 4)						
b. INDIRECT CAUSE(s) (Attach additional sheets as needed, See page 5)						

14. ACTION(s) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(s)		
DESCRIBE FULLY (Attach additional sheets as necessary, See page 5)		
15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.		
a. BEGINNING (YYYYMMDD)		b. ANTICIPATED COMPLETION (YYYYMMDD)
c. DATE SIGNED (YYYYMMDD)	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CORPS SIGNATURE, SUPERVISOR COMPLETING REPORT
		
c. DATE SIGNED (YYYYMMDD)	d. TITLE OF SUPERVISOR COMPLETING REPORT	e. CONTRACTOR SIGNATURE, SUPERVISOR COMPLETING REPORT
		
f. ORGANIZATION IDENTIFIER (Division, Branch, Section, etc.,)		g. OFFICE SYMBOL
16. MANAGEMENT REVIEW (1st)		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NONCONCUR c. COMMENTS		
DATE (YYYYMMDD)	TITLE	SIGNATURE
		
17. MANAGEMENT REVIEW (2nd - Chief Operations, Construction, Engineering, etc.,)		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NONCONCUR c. COMMENTS		
DATE (YYYYMMDD)	TITLE	SIGNATURE
		
18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NONCONCUR c. ADDITIONAL ACTIONS/COMMENTS		
DATE (YYYYMMDD)	TITLE	SIGNATURE
		
19. COMMAND APPROVAL		
COMMENTS		
DATE (YYYYMMDD)	COMMANDER SIGNATURE	
		

10.

ACCIDENT DESCRIPTION (Continuation)

13a.

DIRECT CAUSE(s) (Continuation)

13b.

INDIRECT CAUSE(s) (Continuation)

14.

ACTION(s) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(s) (Continuation)

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident (*excluding uninjured personnel and witnesses*). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the discretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. **GOVERNMENT.** Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (*injury*), CA-2 (*illness*) or CA-6 (*fatality*) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) **PROPERTY DAMAGE** - Mark the appropriate box if accident resulted in any damage of \$1000 or more to government property (*including motor vehicles*).

(3) **VEHICLE INVOLVED** - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) **DIVING ACTIVITY** - Mark if the accident involved an in-house USACE diving activity.

b. **CONTRACTOR.**

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) **PROPERTY DAMAGE** - Mark the appropriate box if accident resulted in any damage of \$1000 or more to contractor property (*including motor vehicles*).

(3) **VEHICLE INVOLVED** - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) **DIVING ACTIVITY** - Mark if the accident involved a USACE Contractor diving activity.

c. **PUBLIC.**

(1) **INJURY/ILLNESS/FATALITY** - Mark if accident resulted in public fatality or permanent total disability. (*The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander.*)

(2) **VOID SPACE** - Make no entry.

(3) **VEHICLE INVOLVED** - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) **VOID SPACE** - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. **NAME** - (*MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS*). Enter last name, first name, middle initial of person involved.

b. **AGE** - Enter age.

c. **SEX** - Mark appropriate box.

d. **SOCIAL SECURITY NUMBER** - (*FOR GOVERNMENT PERSONNEL ONLY*) Enter the social security number (*or other personal identification number if no social security number issued*).

e. **GRADE** - (*FOR GOVERNMENT PERSONNEL ONLY*) Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. **JOB SERIES/TITLE** - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-0810/Civil Engineer. For military personnel enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. **DUTY STATUS** - Mark the appropriate box.

(1) **ON DUTY** - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) **TDY** - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) **OFF DUTY** - Person was not on official business at time of accident.

h. **EMPLOYMENT STATUS** - (*FOR GOVERNMENT PERSONNEL ONLY*) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

- a. DATE OF ACCIDENT - Enter the month, day, and year of accident.
- b. TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).
- c. EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene, (installation/project name, building number, street, direction and distance from closest landmark, etc.).
- d. CONTRACTOR NAME
- (1) PRIME - Enter the exact name (title of firm) of the prime contractor.
- (2) SUBCONTRACTOR - Enter the name of any subcontractor involved in the accident.
- e. CONTRACT NUMBER - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.
- f. TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.
- g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW) - Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

- a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

- | | |
|-------------------------|----------------------------|
| 1. MOBILIZATION | 13. CARPENTRY |
| 2. SITE PREPARATION | 14. ELECTRICAL |
| 3. EXCAVATION/TRENCHING | 15. SCAFFOLDING/ACCESS |
| 4. GRADING (EARTHWORK) | 16. MECHANICAL |
| 5. PIPING/UTILITIES | 17. PAINTING |
| 6. FOUNDATION | 18. EQUIPMENT/MAINTENANCE |
| 7. FORMING | 19. TUNNELING |
| 8. CONCRETE PLACEMENT | 20. WAREHOUSING/STORAGE |
| 9. STEEL ERECTION | 21. PAVING |
| 10. ROOFING | 22. FENCING |
| 11. FRAMING | 23. SIGNING |
| 12. MASONRY | 24. LANDSCAPING/IRRIGATION |
| | 25. INSULATION |
| | 26. DEMOLITION |

- b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

- | | |
|------------------------------------|--------------------------------|
| 1. GRADER | 12. DUMP TRUCK (HIGHWAY) |
| 2. DRAGLINE | 13. DUMP TRUCK (OFF HIGHWAY) |
| 3. CRANE (ON VESSEL/BARGE) | 14. TRUCK (OTHER) |
| 4. CRANE (TRACKED) | 15. FORKLIFT |
| 5. CRANE (RUBBER TIRE) | 16. BACKHOE |
| 6. CRANE (VEHICLE MOUNTED) | 17. FRONT-END LOADER |
| 7. CRANE (TOWER) | 18. PILE DRIVER |
| 8. SHOVEL | 19. TRACTOR (UTILITY) |
| 9. SCRAPER | 20. MANLIFT |
| 10. PUMP TRUCK (CONCRETE) | 21. DOZER |
| 11. TRUCK (CONCRETE/TRANSIT MIXER) | 22. DRILL RIG |
| | 23. COMPACTOR/VIBRATORY ROLLER |
| | 24. OTHER |

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

- a. SEVERITY OF INJURY/ILLNESS - Reference paragraph 2-10 of USACE Supplement 1 to AR 385-40 and enter code and description from list below.

- | | |
|-----|---|
| NOI | NO INJURY |
| FAT | FATALITY |
| PTL | PERMANENT TOTAL DISABILITY |
| PPR | PERMANENT PARTIAL DISABILITY |
| LWD | LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK |
| NLW | RECORDABLE CASE WITHOUT LOST WORKDAYS |
| RFA | RECORDABLE FIRST AID CASE |
| NRI | NON-RECORDABLE INJURY |

- b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME	HEAD, EXTERNAL	H1	EYE EXTERNAL
ARM/WRIST	AB	ARM AND WRIST		H2	BOTH EYES EXTERNAL
	AS	ARM OR WRIST		H3	EAR EXTERNAL
TRUNK, EXTERNAL MUSCULATURE				H4	BOTH EARS EXTERNAL
				HC	CHIN
	B1	SINGLE BREAST		HF	FACE
	B2	BOTH BREASTS		HK	NECK/THROAT
	B3	SINGLE TESTICLE		HM	MOUTH/LIPS
	B4	BOTH TESTICLES		HN	NOSE
	BA	ABDOMEN		HS	SCALP
	BC	CHEST			
	BL	LOWER BACK	KNEE	KB	BOTH KNEES
	BP	PENIS		KS	KNEE
	BS	SIDE	LEG, HIP, ANKLE,	LB	BOTH LEGS/HIPS/ ANKLES/
	BU	UPPER BACK	BUTTOCKS		
	BW	WAIST	BUTTOCK	LS	SINGLE LEG/HIP/ ANKLE/BUTTOCK
	BZ	TRUNK OTHER			
HEAD, INTERNAL			HAND	MB	BOTH HANDS
	C1	SINGLE EAR INTERNAL		MS	SINGLE HAND
	C2	BOTH EARS INTERNAL			
	C3	SINGLE EYE INTERNAL	FOOT	PB	BOTH FEET
	C4	BOTH EYES INTERNAL		PS	SINGLE FOOT
	CB	BRAIN			
	CC	CRANIAL BONES	TRUNK, BONES	R1	SINGLE COLLAR BONE
	CD	TEETH		R2	BOTH COLLAR BONES
	CJ	JAW		R3	SHOULDER BLADE
	CL	THROAT, LARYNX		R4	BOTH SHOULDER BLADES
	CM	MOUTH		RB	RIB
	CN	NOSE		RS	STERNUM (BREAST BONE)
	CR	THROAT, OTHER		RV	VERTEBRAE (SPINE; DISC)
	CT	TONGUE		RZ	TRUNK BONES OTHER
	CZ	HEAD OTHER INTERNAL			
ELBOW	EB	BOTH ELBOWS	SHOULDER	SB	BOTH SHOULDERS
	ES	SINGLE ELBOW		SS	SINGLE SHOULDER
FINGER			THUMB	TB	BOTH THUMBS
	F1	FIRST FINGER		TS	SINGLE THUMB
	F2	BOTH FIRST FINGERS			
	F3	SECOND FINGER	TRUNK, INTERNAL	V1	LUNG, SINGLE
	F4	BOTH SECOND FINGERS	ORGANS	V2	LUNGS, BOTH
	F5	THIRD FINGER		V3	KIDNEY, SINGLE
	F6	BOTH THIRD FINGERS		V4	KIDNEYS, BOTH
	F7	FOURTH FINGER		VH	HEART
TOE	F8	BOTH FOURTH FINGERS		VL	LIVER
	G1	GREAT TOE		VR	REPRODUCTIVE ORGANS
	G2	BOTH GREAT TOES		VS	STOMACH
	G3	TOE OTHER		VV	INTESTINES
	G4	TOES OTHER		VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.

* The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME	TU	BURN, SCALD, SUNBURN
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TB	BACK STRAIN	TR	TRAUMATIC RESPIRATORY DISEASE
	TC	CONTUSION; BRUISE; ABRASION	TQ	TRAUMATIC FOOD POISONING
	TD	DISLOCATION	TW	TRAUMATIC TUBERCULOSIS
	TF	FRACTURE	TX	TRAUMATIC VIROLOGICAL/INFECTIVE/
	TH	HERNIA		
GENERAL NATURE CATEGORY			T1	TRAUMATIC CEREBRAL VASCULAR
			T2	TRAUMATIC HEARING LOSS
			T3	TRAUMATIC HEART CONDITION
	TK	CONCUSSION	T4	TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION
	TL	LACERATION, CUT		
	TP	PUNCTURE	T8	TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS)
	TS	STRAIN, MULTIPLE		

** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE

CATEGORY	CODE	NATURE OF INJURY NAME	
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY			
RESPIRATORY DISEASE	RA	ASBESTOSIS	DD ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	RB	BRONCHITIS	
	RE	EMPHYSEMA	DE EFFECT OF ENVIRONMENTAL
	RP	PNEUMOCOONIOSIS	CONDITION
	RS	SILICOSIS	DH HEARING LOSS
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	R9	RESPIRATORY DISEASE, OTHER	DK HEART CONDITION
			DM MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS CONDITION
	VB	BRUCELLOSIS	DR RADIATION
	VC	COCCIDIOMYCOSIS	DS STRAIN, MULTIPLE
	VF	FOOD POISONING	DU ULCER
	VH	HEPATITIS	DV OTHER VASCULAR CONDITIONS
	VM	MALARIA	D9 DISABILITY, OTHER
	VS	STAPHYLOCOCCUS	
	VT	TUBERCULOSIS	SKIN DISEASE OR CONDITION
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER	SB BIOLOGICAL
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS	SC CHEMICAL
	DB	BACK STRAIN, BACK SPRAIN	S9 DERMATITIS, UNCLASSIFIED
	DC	CEREBRAL VASCULAR CONDITION; STROKE	

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk. TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface).

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/oak.

TYPE: 510 (contact) SOURCE: 0820 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.

TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle.

TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME	CODE	SOURCE OF INJURY NAME
		0610	EXERTED
		0620	LIFTED, STRAINED BY (SINGLE ACTION)
			STRESSED BY (REPEATED ACTION)
0110	STRUCK		EXPOSED
0111	STRUCK BY	0710	INHALED
0120	STRUCK BY FALLING OBJECT	0720	INGESTED
	STRUCK AGAINST	0730	ABSORBED
	FELL, SLIPPED, TRIPPED	0740	EXPOSED TO
0210	FELL ON SAME LEVEL	0800	TRAVELING IN
0220	FELL ON DIFFERENT LEVEL		
0230	SLIPPED, TRIPPED (NO FALL)		
	CAUGHT	CODE	SOURCE OF INJURY NAME
0310	CAUGHT ON		
0320	CAUGHT IN	0100	BUILDING OR WORKING AREA
0330	CAUGHT BETWEEN	0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.)
	PUNCTURED, LACERATED		STAIRS, STEPS
0410	PUNCTURED BY	0120	LADDER
0420	CUT BY	0130	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0430	STUNG BY	0140	BOILER, PRESSURE VESSEL
0440	BITTEN BY	0150	EQUIPMENT LAYOUT (ERGONOMIC)
	CONTACTED	0160	WINDOWS, DOORS
0510	CONTACTED WITH (INJURED PERSON MOVING)	0170	ELECTRICITY
0520	CONTACTED BY (OBJECT WAS MOVING)	0180	

0200	ENVIRONMENTAL CONDITION	0631	CARBON MONOXIDE
0210	TEMPERATURE EXTREME (INDOOR)	0640	MIST, STEAM, VAPOR, FUME
0220	WEATHER (ICE, RAIN, HEAT, ETC.)	0641	WELDING FUMES
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)	0650	PARTICLES (UNIDENTIFIED)
0240	NOISE	0700	CHEMICAL, PLASTIC, ETC.
0250	RADIATION	0711	DRY CHEMICAL - CORROSIVE
0260	LIGHT	0712	DRY CHEMICAL - TOXIC
0270	VENTILATION	0713	DRY CHEMICAL - EXPLOSIVE
0271	TOBACCO SMOKE	0714	DRY CHEMICAL FLAMMABLE
0280	STRESS (EMOTIONAL)	0721	LIQUID CHEMICAL - CORROSIVE
0290	CONFINED SPACE	0722	LIQUID CHEMICAL - TOXIC
0300	MACHINE OR TOOL	0723	LIQUID CHEMICAL - EXPLOSIVE
0310	HAND TOOL (POWERED; SAW, GRINDER, ETC.)	0724	LIQUID CHEMICAL - FLAMMABLE
0320	HAND TOOL (NONPOWERED)	0730	PLASTIC
0330	MECHANICAL POWER TRANSMISSION APPARATUS	0740	WATER
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)	0750	MEDICINE
0350	VIDEO DISPLAY TERMINAL	0800	INAMINATE OBJECT
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL	0810	BOX, BARREL, ETC.
0370	HEATING EQUIPMENT	0820	PAPER
0380	WELDING EQUIPMENT	0830	METAL ITEM, MINERAL
0400	VEHICLE	0831	NEEDLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE	0840	GLASS
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE	0850	SCRAP, TRASH
0421	DRIVER OF GOVERNMENT VEHICLE	0860	WOOD
0422	PASSENGER OF GOVERNMENT VEHICLE	0870	FOOD
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)	0880	CLOTHING, APPAREL, SHOES
0440	AIRCRAFT (NOT COMMERCIAL)	0900	ANIMATE OBJECT
0450	BOAT, SHIP, BARGE	0911	DOG
0500	MATERIAL HANDLING EQUIPMENT	0912	OTHER ANIMAL
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)	0920	PLANT
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)	0930	INSECT
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST	0940	HUMAN (VIOLENCE)
0540	HOIST, SLING CHAIN, JACK	0950	HUMAN (COMMUNICABLE DISEASE)
0550	CRANE	0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)
0561	FORKLIFT	1000	PERSONAL PROTECTIVE EQUIPMENT
0560	HANDTRUCK, DOLLY	1010	PROTECTIVE CLOTHING, SHOES, GLASSES,
0600	DUST, VAPOR, ETC.		GOGGLES
0610	DUST (SILICA, COAL, ETC.)	1020	RESPIRATOR, MASK
0620	FIBERS	1021	DIVING EQUIPMENT
0621	ASBESTOS	1030	SAFETY BELT, HARNESS
0630	GASES	1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. **ACTIVITY AT TIME OF ACCIDENT** - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating-powered
3. Boating-unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving, scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.)
24. Sports/winter (skiing, sledding, snowmobiling etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area

b. **PERSONAL FLOTATION DEVICE USED** - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

a. **TYPE OF VEHICLE** - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. **TYPE OF COLLISION** - Mark appropriate box.

c. **SEAT BELT** - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. **NAME OF ITEM** - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. **OWNERSHIP** - Enter ownership for each item listed. (Enter one of the following: *USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE*)

c. **\$ AMOUNT OF DAMAGE** - Enter the total estimated dollar amount of damage (*parts and labor*), if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/FLOATING PLANT ACCIDENT

a. **TYPE OF VESSEL/FLOATING PLANT** - Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. **COLLISION/MISHAP** - Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEEP DOWN ON DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

- (1) **DESIGN** - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?
- (2) **INSPECTION/MAINTENANCE** - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?
- (3) **PERSON'S PHYSICAL CONDITION** - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?
- (4) **OPERATING PROCEDURES** - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?
- (5) **JOB PRACTICES** - Were any of the provisions of the Safety and Health Requirements Manual (*EM 385-1-1*) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (*including EM 385-1-1*) fail to adequately address the task or work process? Would better job practices improve the safety of the task?
- (6) **HUMAN FACTORS** - Was the person under undue stress (*either internal or external to the job*)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?
- (7) **ENVIRONMENTAL FACTORS** - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) **CHEMICAL AND PHYSICAL AGENT FACTORS** - Did exposure to chemical agents (*either single shift exposure or long-term exposure*) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) **OFFICE FACTORS** - Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) **SUPPORT FACTORS** - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (*in terms of employee skills, number of workers, and adequate supervision*) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) **PERSONAL PROTECTIVE EQUIPMENT** - Did the person fail to use appropriate personal protective equipment (*gloves, eye protection, hard-toed shoes, respirator, etc.*) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) **DRUGS/ALCOHOL** - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. **WRITTEN JOB/ACTIVITY HAZARD ANALYSIS** - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

INSTRUCTIONS FOR SECTION 12 - TRAINING

a. **WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?** - For the purpose of this section "trained" means the person has been provided the necessary information (*either formal and/or on-the-job (OJT) training*) to competently perform the activity/task in a safe and healthful manner.

b. **TYPE OF TRAINING** - Mark the appropriate box that best indicates the type of training; (*classroom or on-the-job*) that the injured person received, before the accident happened.

c. **DATE OF MOST RECENT TRAINING** - Enter YYYYMMDD of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. **DIRECT CAUSES** - The direct cause is that single factor, which most directly lead to the accident. See examples below.

b. **INDIRECT CAUSES** - Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation. Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (*possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety*); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (*Note: USACE vehicle was in proper/safe working condition*).

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.

Indirect cause: failure of employee to pay attention to driving (*defensive driving*).

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date YYYYMMDD when the corrective action(s) identified in section 14 will be completed.

c. **DATE SIGNED** - Enter YYYYMMDD that the report was signed by the responsible supervisor.

d.e.. **TITLE AND SIGNATURE** - Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15c., 15d., 15e., 15f. and 15g. below, the responsible USACE supervisor shall forward the report for management review as indicated in section 16.

f. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name (*Division, Branch, Section, etc.*) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15d. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

g. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15f.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15d. shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (*2nd review*) for review and comment.

INSTRUCTIONS FOR SECTION 17 - MANAGEMENT REVIEW (2nd)

2ND REVIEW - The FOA Staff Chief (*i. e., FOA Chief of Construction, Operations, Engineering, Planning, etc.*) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 - SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 - COMMAND APPROVAL

4TH REVIEW - The FOA Commander shall (*to include the person designated Acting Commander in his absence*) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

Americas

SH&E Incident Report Form

S3NA-004-FM1

GENERAL DETAILS	
Project Name (if applicable):	Project Number:
Report Completed By:	
EMPLOYEE DETAILS	
Injured Employee Name:	Employee ID/Number:
<input type="checkbox"/> AECOM <input type="checkbox"/> Subcontractor <input type="checkbox"/> Other	Employee Phone #:
Location Employee Assigned To:	Time Employee Started Work:
Supervisor Managing Work:	Supervisor Phone #:
Incident Occurred While On: <input type="checkbox"/> AECOM Premises <input type="checkbox"/> Client Site <input type="checkbox"/> Travel <input type="checkbox"/> Other:	Address:
Event Type: <input type="checkbox"/> Injury/Illness <input type="checkbox"/> Fire <input type="checkbox"/> Property Damage <input type="checkbox"/> Spill/Release <input type="checkbox"/> Motor Vehicle Incident <input type="checkbox"/> Other:	
Injury Type: <input type="checkbox"/> Injury <input type="checkbox"/> Illness <input type="checkbox"/> First Aid <input type="checkbox"/> Information Only (no treatment)	
Date of Incident:	Time of Incident:
Date Reported to Supervisor:	Time Reported to Supervisor:
Brief Description of Incident (what happened, severity of injury, and status of injured people including levels of medical treatment, work status):	
Employee Description of Incident – Has the Employee completed the Statement Form (see page 4)?	
<input type="checkbox"/> Yes <input type="checkbox"/> No, state reason:	
What was the employee doing just before the incident occurred? (Name tools, equipment, material and what the employee was doing with them):	
How did the incident occur? (What and how details, name object(s), substance(s) involved):	

What object(s) or substance(s) directly harmed the employee?		
What was the injury or illness (Provide a brief description of the body part/nature of injury):		
MEDICAL TREATMENT		
What level of medical treatment was received?		
<input type="checkbox"/> First Aid <input type="checkbox"/> Clinic/Physician <input type="checkbox"/> Emergency Room <input type="checkbox"/> Refused/None		
Was injured hospitalized overnight as an inpatient? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Was treatment provided on site? <input type="checkbox"/> Yes <input type="checkbox"/> No		
Describe:		
Hospital/Occupational Clinic Name:		Physician Name:
CONTRIBUTING CAUSES		
Contributing Causes:		
ROOT CAUSE DETERMINATION		
Root Cause(s):		
CORRECTIVE ACTIONS		
List methods of preventing/avoiding this type of incident in the future. There must be one or more corrective actions for each root cause.		
Corrective Action	Responsible Party	Due Date

Motor Vehicle Incident Report**ONLY COMPLETE THIS PAGE FOR VEHICLE INCIDENTS****ADMINISTRATIVE**AECOM Vehicle: ☐ Fleet ☐ Rental ☐ Personal Number of Vehicles Involved?

Date of Incident: Location of Incident:

Time of Incident: Manager:

Job Activity at Time of Incident:

AECOM DRIVER INFORMATION

Driver's Name: Employee Number:

AECOM Passengers: Other Passengers:

Driver's License #: Province/State Issued: Expiration Date:

Injuries to Driver:

Injuries to Passengers:

AECOM VEHICLE INFORMATION

Year: Make: Model:

License Plate #: Serial/Vehicle Identification #: Registration #:

Owner: Insurance Company: Policy #:

Commercial Motor Vehicle: - If Rented or Personal, Contact Information of Owner:Rate Intensity of the Damage to the Vehicle ☐ 0 - \$500 ☐ \$500 - \$1,000 ☐ \$1,000 - \$5,000 ☐ >\$5,000

Description of Damage to the Body of the Vehicle:

OTHER DRIVER'S VEHICLE / INFORMATION

Driver's Name: Contact Info: License #:

Year: Make: Model:

License Plate #: Serial/Vehicle Identification #: Registration #:

Owner: Insurance Company: Policy #:

Description of Damage to the Body of the Vehicle:

INCIDENT DESCRIPTION

Exact Location (Highway km, Intersection, Exact Address, etc.):

Other Property Damaged:

Describe the Events Leading up to and the Incident (Report facts only, speed of vehicles, direction travelling, weather conditions). Do not give opinions regarding cause of accident or loss.

Did the Police Attend the Scene: ☐ Yes ☐ No Citations Issued: ☐ Yes ☐ No To Who:

Police: Contact Info:

Witness: Contact Info:

Witness: Contact Info:

STATEMENT FORM	
Name of Individual Providing Statement:	Name of Employee(s) Involved In Incident:
This is a statement from: <input type="checkbox"/> Employee Involved in Incident <input type="checkbox"/> Supervisor <input type="checkbox"/> Witness	
Describe the incident in as much detail as possible (attach additional pages if needed).	
I understand that any misrepresentation or material omission made by me on this Statement Form will be sufficient cause for immediate termination of employment whenever it may be discovered. I represent and warrant that I have read and fully understand the foregoing, that all information I have provided on this Statement Form is true and accurate.	
Signature of Individual Providing Statement:	
Date:	Contact Phone Number:

Americas

Journey Management Plan

S3AM-005-FM1

Journey Management Plan – required for trips > 250 miles / 400 kilometers (one way)			
1. Driver and Passenger Information			
Driver Name:		Driver Training Completed:	
Passengers:			
2. Vehicle Information			
Vehicle Type/Description/Registration No.:			
3. Trip Information			
What is the purpose of the trip?		Estimated distance:	
Single Trip: <input type="checkbox"/> Reoccurring Trip: <input type="checkbox"/> / / to / /			
Have alternate modes of travel (telepresence, public transportation, air,) been evaluated? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Has a Safe Work Plan or Task Hazard Assessment been completed and attached? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> NA			
Destination 1:			
Departure Date:	Time:	Arrival Date:	Time (ETA):
Destination 2:			
Departure Date:	Time:	Arrival Date:	Time (ETA):
Destination 3:			
Departure Date:	Time:	Arrival Date:	Time (ETA):
Destination 4:			
Departure Date:	Time:	Arrival Date:	Time (ETA):
4. Special Conditions / Hazards (Check all that may apply)			
<input type="checkbox"/> Night Driving <input type="checkbox"/> Weather <input type="checkbox"/> Long Driving / Fatigue (Over 2 hours) <input type="checkbox"/> Towing (e.g., trailer) <input type="checkbox"/> Potential for distraction <input type="checkbox"/> Other		<input type="checkbox"/> Rugged Terrain (4 x 4) <input type="checkbox"/> Large Vehicles <input type="checkbox"/> Animals <input type="checkbox"/> Rush Hour/Heavy Traffic <input type="checkbox"/> Road Conditions (e.g., construction, ice, snow) Describe	
Weather forecast:			
5. Contact Information			
Traveler No. 1 (Driver) - Name:		Phone No:	
Traveler No. 1 (Driver) - Personal Contact Name:		Phone No:	
Traveler No. 2 - Name:		Phone No:	
Traveler No. 2 - Personal Contact Name:		Phone No:	
Traveler No. 3 - Name:		Phone No:	
Traveler No. 3 - Personal Contact Name:		Phone No:	
Manager - Name:		Phone No:	
Check-In Contact - Name:		Phone No:	
Alternate Check-In Contact - Name:		Phone No:	
Destination Contact (if applicable) - Name:		Phone No:	
Other (description)	Name:	Phone No:	
Other (description)	Name:	Phone No:	

6. Route of Travel		
Route of travel (insert map or give detailed route directions):		
Is the return route of travel the same? <input type="checkbox"/> Yes <input type="checkbox"/> No		
7. Check-In Procedure		
<ul style="list-style-type: none"> • Check-In Interval - • Advise Manager and any other applicable personnel of travel plans and supply with a copy of this form (including attachments) • Confirm availability of Manager or Check-In Contact. Confirm check-in interval with Manager or Check-In Contact. • Discuss with contacts the possibility of travel within a cell phone "dead zone". • Advise Manager or Check-In Contact of departure. • Call Manager or Check-In Contact upon arrival at destination (e.g. worksite, office, home). • If multiple destinations, the process is repeated. 		
7.A Missed Check-In Procedure for Manager		
<ul style="list-style-type: none"> • Attempt to call traveler(s) using contact number(s) listed above. • Contact traveler's personal contact listed above. • If unsuccessful, discuss options with Manager, Check-In Contact (is anyone nearby who can be sent out along the route to destination, how much daylight remains, etc.?). • Call 911 or local police. 		
8. Emergency Planning		
AECOM Supervisor	Name:	Phone Number:
AECOM Manager	Name:	Phone Number:
Roadside Service:		
WorkCare: 1-877-878-9525		
9. Approvals: All Journey Management Plans shall be reviewed and acknowledged by the driver and the driver's manager / supervisor. Copies of the form shall remain with the driver and the manager / supervisor for the duration of the journey. (Electronic copies are acceptable).		
Driver's Signature:		
Manager or Supervisor	Name:	Signature:

Americas

Vehicle Inspection Checklist

S3NA-005-FM2

Vehicle Tag No:	Mileage:	Date:	Time:	Driver Name:	Location:		
Inspection Checklist: This Pre-Trip Vehicle Inspection Checklist is intended to be completed by the vehicle driver prior to departing on a trip. Checking boxes means that item is present and functioning. Deficiencies that affect or could potentially affect the safe operation of the vehicle shall be repaired or corrected prior to departure. This checklist should only be used in addition to an on-going vehicle maintenance program.							
Item					Yes	No	N/A
1. General							
1-1 Proof of insurance and registration available and current?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1-2 Is the date of the last regular maintenance known, or is the mileage/date of next scheduled maintenance known?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1-3 Is the overall condition of the vehicle good (no body damage, unusual sounds, leaks, odors, etc.)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Tires							
2-1 Do all tires have sufficient tread for driving conditions? Legal limit: 2/32" (for rain/snow: > 4/32")					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2-2 Are tires sufficiently inflated for driving conditions?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2-3 Are the lug nuts and stem caps present and tight for each tire?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2-4 Is the spare tire and jack present and in good condition?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Vehicle Interior							
3-1 Are the brake and accelerator pedal pads in good condition?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-2 Are the floor mats in good condition and not interfering with the brake or accelerator pedals?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-3 Is the seat properly adjusted (including the headrest)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-4 Is the seatbelt in good condition?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-5 Are the mirrors in good condition (not broken, dirty)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-6 Are the dashboard/instrument lights working?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-7 Is the dashboard free of warning lights and do the gauges appear to work when the car is started?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-8 Does the horn work?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3-9 Are distractions such as cell phones and GPS units secured so they do not encourage use?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Lights and Signals							
4-1 Do the headlights and high beams work?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-2 Do the tail lights function properly?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-3 Do the turn signals work (front and rear)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-4 Do the brake lights work (including high light in the rear window if applicable)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-5 Do the hazard lights (emergency flashers) work?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-6 Do back up / reverse lights work?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4-7 If equipped with a back-up alarm can it be heard clearly?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Mechanical							
5-1 Do the brakes work and feel solid (not soft)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-2 Does the parking/emergency brake work?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-3 Is the steering in good working condition (not loose)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-4 Is the engine oil level full or in the operating zone?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5-5 Excessive vehicle bounce going over bumps reported (possible sign of worn shock absorbers)?					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Item	Yes	No	N/A
6. Windows and Windshield			
6-1 Is the windshield clean and unbroken?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6-2 Are the wiper blades in good condition (front and rear)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6-3 Are all the windows clean and unbroken and windshield fluid available and operational?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Emergency Equipment (as needed per conditions/project requirements)			
7-1 Is there a "Safety Kit" (fire extinguisher, first aid, safety triangle and 2 reflective vests)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-2 Is there a first aid kit, has it been inspected recently?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-3 Is survival gear and equipment available (blanket, water, heat source, flashlight, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7-4 Is a means for emergency communication available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Other Equipment (as needed per conditions/project requirements)			
8-1 Is there a means to secured loads (cargo next, container)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-2 Are cones or other warning devices available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-3 Is weather specific equipment (snow chains, tired etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-4 Does the vehicle have a snow brush/ice scraper?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8-5 Does the vehicle have a fire extinguisher?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Comments			
Inspector Name:	Signature:	Date:	

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Behavior Based Safety Checklist

S3NA-007-FM1

Use comment column when unsafe behavior / conditions were observed. Describe what was observed and why this occurred.

Job Location: _____

Date: _____

Task/Work Observed: _____

Observer: _____

	<u>Safe</u>	<u>Unsafe</u>	<u>Comments</u>
Personal Protective Equipment			
Head	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hand	<input type="checkbox"/>	<input type="checkbox"/>	_____
Feet	<input type="checkbox"/>	<input type="checkbox"/>	_____
Eyes/Face	<input type="checkbox"/>	<input type="checkbox"/>	_____
Skin	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hearing	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fall Protection	<input type="checkbox"/>	<input type="checkbox"/>	_____
Equipment / Tools			
Proper tool for the job	<input type="checkbox"/>	<input type="checkbox"/>	_____
Condition	<input type="checkbox"/>	<input type="checkbox"/>	_____
Proper Use	<input type="checkbox"/>	<input type="checkbox"/>	_____
Body Use / Position			
Lifting	<input type="checkbox"/>	<input type="checkbox"/>	_____
Pinch Point	<input type="checkbox"/>	<input type="checkbox"/>	_____
Ladder / stairs	<input type="checkbox"/>	<input type="checkbox"/>	_____
Hand placement	<input type="checkbox"/>	<input type="checkbox"/>	_____
Travel path / speed	<input type="checkbox"/>	<input type="checkbox"/>	_____
Body position	<input type="checkbox"/>	<input type="checkbox"/>	_____
Work Practices			
Follow Safety Plan / Procedures	<input type="checkbox"/>	<input type="checkbox"/>	_____
Housekeeping	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other			
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____

Americas

First Aid Kit Inventory & Inspection

S3AM-012-FM1

This form is used to record the required contents of the first aid kit as well as document monthly or weekly First Aid Kit inspections. The column 'Qty' (quantity) is to be completed according to jurisdictional requirements and/or approval prior to the first aid kit being delivered to its intended location and at the beginning of each calendar year thereafter. Any listed items that are not required by the given jurisdiction or approved to be included in the first aid kit shall have 'N/A' entered in the corresponding 'Qty' box.

Project/Location/ Office Name:		Address:	
First Aid Kit Type:		Kit Location:	
First Aid Kit ID #:		Date:	

Monthly or weekly inspections require the inspector to record the actual quantity of required items in the corresponding column. Items deficient in number must be restocked. Unapproved items shall be removed from the First Aid Kit.

Weekly inspection requires the inspector to place a '✓' as quantity satisfactory or an 'x' as deficient in one of the four weekly cells for the given month. Inspector will note replacements and date in the comment section.

Item (Year)	Qty	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
First Aid Manual (<i>current</i>)													
Adhesive Bandage													
Elastic Adhesive Bandage													
Gauze Roller Bandage													
Triangular Bandage													
Conforming Bandage													
Tensor Bandage													
Safety Pins													
Adhesive Tape													
Adhesive Bandage													
Antiseptic (<i>solution/swabs</i>)													
Burn Treatment													
Medical Exam Gloves													
Dressing (<i>Sterile Pad</i>) Sz/ Type													
Dressing (<i>Sterile Pad</i>) Sz/ Type													
Dressing (<i>Sterile Pad</i>) Sz/ Type													
Dressing (<i>Sterile Pad</i>) Sz/ Type													
Dressing (<i>self-adherent roller</i>)													

Item (Year)	Qty	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Eye Pad (with Shield/Tape)													
Breathing Barrier (CPR use)													
Bandage Scissors													
Soap													
Cold Compress													
Splinter Forceps													
Waterless Hand Cleaner													
Waterproof Waste Bag													
Eye Wash													
Tweezers													
Biohazard clean-up kit with two disposal bags													

Inspector(s) shall record his/her name, record any comments regarding the inspection (including items replaced) and initial once complete.

MONTH	Inspector Name	Comments	Initials
January			
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			

Americas

Housekeeping Inspection

S3NA-013-FM1

Building or Location: _____

Inspection Conducted by: _____

Date: _____

Check Yes, No, or NA for Not Applicable.

General Site Housekeeping

- | | | | | |
|----|--|------------------------------|-----------------------------|-----------------------------|
| 1. | Exits, emergency equipment, and electrical panels unblocked? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 2. | Equipment, materials, supplies properly stored and, as applicable, secured (e.g. chocked)? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 3. | Drawers closed when not in use? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 4. | Equipment, including desks and chairs, in good repair? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 5. | Storage areas free from the accumulation of materials that constitute trip hazards? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 6. | Recyclable material, debris and trash collected and stored in appropriate containers? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 7. | Scrap materials and other debris removed from work area? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 8. | Combustible scrap and debris removed by safe means at regular intervals? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 9. | Oily rags removed at the end of the day and stored in metal cans with tight fitting lids? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Visibility

- | | | | | |
|-----|--|------------------------------|-----------------------------|-----------------------------|
| 10. | Worksite and, as applicable, halls, stairways and walkways are well lit? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 11. | Well-designed light switches are present in areas where walkways are not always lighted? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 12. | Dust, smoke or steam does not create poor visibility? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 13. | Glare from floodlights or windows does not create poor visibility in work areas? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Stairs

- | | | | | |
|-----|---|------------------------------|-----------------------------|-----------------------------|
| 14. | Handrails are tight and at the proper level? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 15. | Handrails extend past the top and bottom step? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 16. | White or yellow strips are painted on the first and last step for better visibility? (recommendation only). | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 17. | Steps are not rough or defective? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 18. | Stair treads are wide enough and risers consistently spaced? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 19. | Stairs are free of obstructions? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

Floor Conditions

- | | | | | |
|-----|---|------------------------------|-----------------------------|-----------------------------|
| 20. | Floors of every workroom are clean, and so far as possible, in a dry condition? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 21. | Floors are not oily, overly waxed, or polished. | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 22. | Where wet floors or processes are present, proper drainage and false floors, mats, or other dry standing places are provided? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 23. | Floor surfaces finished with non-slip coatings where spills are likely? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 24. | Floors and passageways are free from protruding nails, splinters, holes, or loose boards? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 25. | Floors are free of holes and depressions? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 26. | Aisles or pathways are wide enough for easy passage and for carrying objects (48 inches is recommended)? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |
| 27. | Ramps are covered with non-slip surfaces or matting? | <input type="checkbox"/> Yes | <input type="checkbox"/> No | <input type="checkbox"/> NA |

28. Carpets or rugs free from loose or frayed edges that may catch boots or shoes? ☐ Yes ☐ No ☐ NA
29. Extension cords, air hoses and cables removed from walkways, or otherwise managed to prevent trip hazards? ☐ Yes ☐ No ☐ NA
30. Pathways free from boxes, containers, machine parts, or other tripping hazards? ☐ Yes ☐ No ☐ NA

Ground Conditions

31. Trip hazards are not present? ☐ Yes ☐ No ☐ NA
32. Fall hazards are not present? ☐ Yes ☐ No ☐ NA
33. Holes or changes in ground elevation are either filled or guarded? ☐ Yes ☐ No ☐ NA
34. Muddy or icy walkways are provided with traction material (e.g. sand, gravel) to reduce slipping? ☐ Yes ☐ No ☐ NA

Equipment

35. Vehicle steps are free from debris or obstructions and of adequate size, and surface placement for safe dismounting? ☐ Yes ☐ No ☐ NA
36. Hand grips or ladders are free from debris or obstructions and adequate for getting into and out of equipment? ☐ Yes ☐ No ☐ NA
37. Ladders have been checked for damage and removed from service if found unsafe? ☐ Yes ☐ No ☐ NA

Chemicals

38. Chemicals are properly stored to minimize a potential spill? ☐ Yes ☐ No ☐ NA
39. Spill cleanup materials are available and appropriate for the type of potential spill? ☐ Yes ☐ No ☐ NA

Smoking, Eating and Drinking

40. Smoking permitted in designated areas only? ☐ Yes ☐ No ☐ NA
41. Designated smoking area appropriately placed? ☐ Yes ☐ No ☐ NA
42. Appropriate and clean eating and drinking areas designated away from work areas? ☐ Yes ☐ No ☐ NA
43. Food and drink items properly stored? ☐ Yes ☐ No ☐ NA
44. Potable water identified and readily available? ☐ Yes ☐ No ☐ NA

Sanitation

45. Appropriate cleaning supplies available and properly stored? ☐ Yes ☐ No ☐ NA
46. Hand and face washing facilities available and maintained with adequate supplies? ☐ Yes ☐ No ☐ NA
47. Adequate toilet facilities available and maintained with sufficient supplies? ☐ Yes ☐ No ☐ NA

Identify areas that need attention and describe the corrective actions to be implemented:

I certify that the above inspection was performed to the best of my knowledge and ability, based on the conditions present.

Signature

Date

Americas

Heat Stress Monitoring Log

S3NA-113-FM1

The purpose of this form is to monitor employees for heat illness when applicable. It is the responsibility of the Foreman or Supervisor-in-Charge to ensure that each person completes the required information.

Project Name:			Foreman/Supervisor:						Work/Rest Schedule1: IN (min) OUT (min)								
Date:	Water Provided¹		Acclimated²		Initial Vitals³	Vital Signs and Time In/Out³ Celcius <input type="checkbox"/> / Farenheit <input type="checkbox"/> (select one)											
Employee Name	Yes	No	Yes	No	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)	Vitals	In (P ₁)	Out (P ₁)	
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			
					P			P			P			P			
					BP			BP			BP			BP			
					Temp			Temp			Temp			Temp			

1. Each Employee should be provided a sufficient amount of water or sports drink before entering the hot zone. Drinks such as coffee and cola should be discouraged.
2. An Employee is "acclimated" if he/she has worked in a hot environment for at least 5 - 7 consecutive days. If an Employee is acclimated, check "Yes." If an Employee is not acclimated, check "No" and reduce the "Min In" by 50 percent for that Employee until the 5 - 7 -day period is reached.
3. "Vitals" refers to Employee vital signs (e.g., pulse [P], blood pressure [BP], body temperature [Temp], etc.). Initial vitals must be taken and recorded before the start of work and at each break period, or as specified in the Heat Stress Exposure Control Plan.

Heat Stress Monitoring Log (S3NA-113-FM1)

Revision 0 March 1, 2016

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Flammable & Combustibles Inspection

S3NA-126-FM1

Location Inspected: _____ Job No.: _____

Date Inspected: _____ Name of Inspector: _____

Fillable fields in the item description shall be completed with the applicable jurisdictional requirement.			
Storage Cabinets			
1. Flammable cabinets do not obstruct room exits.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
2. No more than _____ gallons (_____ liters) of flammable or _____ gallons (_____ liters) of combustible liquid are stored in a cabinet.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
3. No more than three cabinets are located in a storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
4. Metal storage cabinets have self-closing doors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
5. Cabinets are labeled "FLAMMABLE – KEEP FIRE AWAY"	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Safety Cans			
6. Safety cans are constructed of stainless steel, Monel, or tin.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
7. Safety cans have a flame arrestor and spring-loaded cap on both the filling and pouring spouts.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
8. Safety cans have a flame arrestor and spring-loaded cap on both the filling and pouring spouts.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Drum & Drum Storage Areas			
9. Drums are stored in a vertical position.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
10. Bungs are closed when liquid is not being transferred.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
11. Drums are shielded from the sun.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
12. Funnels with installed flash arrestor are used when transferring flammable liquids into drums.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
13. A minimum distance of 25 feet (7.6 meters) between a drum storage area and buildings is present.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
14. A "NO SMOKING" sign is posted in the area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
15. An emergency spill kit is located near the drum storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
16. A 20-pound dry-chemical fire extinguisher is located no less than 10 feet (3 meters) or more than 50 feet (15 meters) from the storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Waste Cans			
17. Combustible scrap, debris, and waste materials (oily rags, etc.) are stored in covered metal cans.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
18. Waste cans are removed from the work area daily.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
19. Waste cans have spring-loaded self-closing lids.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA

Storage Rooms Designed Specifically For Flammable Materials			
20. Room construction meets NFPA fire-resistance requirements.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
21. Rooms with automatic extinguishing systems have the following:			
• Noncombustible liquid-tight raised sills or ramps at least 4 inches (0.36 meters) in height.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Flooring at least 4 inches (0.36 meters) below the surrounding floor, or an open-grated trench that drains to a safe location.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Openings with approved self-closing fire doors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Liquid-tight construction where the walls join the floors.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Shelving, racks, dunnage floor overlay, and other interiors with 1-inch wood.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
22. Rooms are ventilated by a gravity or mechanical exhaust system that:			
• Commences not more than 1 foot (0.3 meter) above the floor.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Is designed to provide for a complete change of air within the room at least six times per hour.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
• Is controlled by a switch located outside the door, with ventilating equipment and any light fixtures operated from the same switch.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Flammable & Combustible Storage Areas Within Buildings			
23. At least one portable fire extinguisher rated not less than 20-B is located outside of but not more than 10 feet (3 meters) from the door opening into any room used for the storage of more than _____ gallons (_____ liters) of flammable or combustible liquids.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
24. Buildings or rooms are locked when not occupied.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
25. Exits, stairways, or passageways are not used for storing flammables and combustibles.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
26. No more than _____ gallons (_____ liters) of _____ liquids or _____ gallons (_____ liters) of _____ liquids are located in a room outside of a flammable storage locker or flammable storeroom.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
27. An aisle at least 3 feet (0.91meters) wide is maintained in storage areas.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
28. No more than those amounts needed for one day's use are stored in buildings under construction.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Outside Storage of Flammable and Combustible Liquids			
29. At least one portable fire extinguisher having a rating of not less than 20-B is located not less than 25 feet (7.6 meters) or more than 75 feet (22.8 meters) from any outside flammable liquid storage area.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
30. For containers not more than _____ gallons each (_____ liters), no more than _____ gallons (_____ liters) in any one group are stored.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
31. Groups of containers are separated by 5-foot (1.52 meters) clearances.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
32. Groups of containers are more than 50 feet (15 meters) from buildings.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
33. Portable tanks (not exceeding _____ gallons [_____ liters] in capacity) are provided with emergency venting devices as specified by NFPA 30.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
34. Storage areas are free of accumulation of weeds, debris, and other combustible materials not necessary to the storage.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA

Storage Tanks			
35. Tanks have relief vents.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
36. Tank vents are not close to open flames, stacks, heating apparatus, or any other source of ignition.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
37. Tanks are double-walled or a dike, curb, or other suitable means is present to prevent the spread of leakage from tanks.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
38. Diked areas have a capacity equal in volume to at least that of the largest tank plus 10 percent of all other tanks in the enclosure.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
39. Provisions to drain off accumulations of ground- or rainwater or spills in diked areas.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
40. Tanks are vented outdoors and away from air intakes and windows.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
41. Impact protection, such as bollards or guard rails, is present for tanks located in areas susceptible to impacts from vehicles or other moving equipment.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Dispensing of Flammable and Combustible Liquids			
42. Dispensing outlets for above-ground tanks with nationally listed automatic-closing valve, without a latch-open device.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
43. Dispensing systems are electrically bonded and grounded.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
44. Tanks, hoses, and containers of 5 gallons (19 liters) or less in metallic contact while transferring flammable liquids (grounding).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
45. Electrically bonded systems are used for transferring flammable liquids in containers in excess of 5 gallons (19 liters).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
46. Closed piping systems are used for drawing flammable liquids during transfer.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
47. Flammables and combustibles are drawn from a container or portable tank by use of gravity or through a pump using an approved self-closing valve.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Liquefied Petroleum Gas – Refueling			
48. Equipment is shut down during refueling operations.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
49. Leather gloves and safety glasses are worn during refueling operations.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
50. Smoking and hot work is prohibited during refueling.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
51. Refueling occurs at least 25 feet (7.6 meters) from buildings.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
Oxidizers			
52. Oxidizers are stored separately from flammables.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
53. When oxidizers are shifted to a second container, the container is labeled with the appropriate warning labels.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
54. Secondary containers are compatible with oxidizers.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
55. Oxidizers are stored away from heat sources where the maximum temperature exceeds 100° F (37.8° C).	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA
56. Chromic acid, nitric acid, perchloric acid, and potassium permanganate (all oxidizers) are stored separately from other corrosives and flammables.	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> NA

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Management Of Change Authorization

S3NA-215-FM1

Description of the Change (include the scope of the change and affected employees):		
Risks Identified:		Mitigation Measures:
1.		1.
2.		2.
3.		3.
4.		4.
5.		5.
MOC Coordinator:		
Print Name	Signature	Date
Evaluation Team:		
Print Name	Signature	Date
Reviewers:		
Print Name	Signature	Date
Timeline for Implementation:		

Comments/Conditions:		
Authorizer Approvals:		
Print Name	Signature	Date

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Competent Person Designation

S3AM-202-FM1

Company: _____	AECOM Manager: _____
Project Location: _____	Program/ Project No: _____
Designated Competent Person: _____	Employee No: _____

Check the technical activity for which the Designation will apply:

<input type="checkbox"/> Asbestos <input type="checkbox"/> Assured Equipment Grounding Conductor <input type="checkbox"/> Blasting & Explosives <input type="checkbox"/> Concrete & Masonry Construction <input type="checkbox"/> Confined Space Entry <input type="checkbox"/> Control of Hazardous Energy (Lockout/Tagout) <input type="checkbox"/> Crane Assembly / Dissassembly <input type="checkbox"/> Cranes & Derricks <input type="checkbox"/> Demolition <input type="checkbox"/> Electrical Wiring Design & Protections <input type="checkbox"/> Elevated work platforms & aerial lifts <input type="checkbox"/> Fall Protection <input type="checkbox"/> Hearing Protection	<input type="checkbox"/> Heavy Equipment <input type="checkbox"/> Ionizing Radiation <input type="checkbox"/> Lead <input type="checkbox"/> Material Hoists & Personnel Hoists <input type="checkbox"/> Respiratory Protection <input type="checkbox"/> Rigging Equipment <input type="checkbox"/> Scaffolds <input type="checkbox"/> Silica <input type="checkbox"/> Stairways & Ladders <input type="checkbox"/> Steel Erection <input type="checkbox"/> Trench & Excavations <input type="checkbox"/> Underground Construction <input type="checkbox"/> Welding & Cutting
---	--

Other (Explain):

The AECOM employee identified has been designated as the Competent Person in the technical area specified by the responsible manager (e.g. Project Manager, Operations Manager, Superintendent) identified. This designation is based on the following:

1. The responsible manager is authorizing the Competent Person to allocate whatever resources that are necessary to perform tasks associated with the area of competency to provide a safe work environment and comply with applicable regulatory and legislative requirements, and AECOM SH&E procedures and policies.
2. The Responsible Manager has confirmed that the individual is competent to perform the required tasks by way of:
 - a. Documented training
 - b. Practical experience (hands-on)
 - c. Documented professional experience
 - d. Legislative knowledge

Print name and sign below

Designated by: _____ (AECOM Manager)	Date: _____
Designated by: _____ (AECOM SH&E Manager)	Date: _____

Comments:

Attach any related documentation of training, certifications, insurance coverages, or other related information that supports the designation of the person as Competent.

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Personal Protective Equipment Assessment

S3AM-208-FM1

Location: _____ Job No.: _____

Date: _____ Assessment conducted by: _____

Specific tasks performed at this location: _____

*If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.
Include any additional guidance in the available section below each item.*

Overhead Hazards

- | | | | |
|----|--|--|---|
| 1. | Suspended/elevated loads, beams, or objects that could fall or strike head | <input type="checkbox"/> Yes <input type="checkbox"/> No | Hard hat, ANSI Z89, Class G, E or C |
| 2. | Flying objects that could strike head | <input type="checkbox"/> Yes <input type="checkbox"/> No | Hard hat, ANSI Z89, Class G, E or C |
| 3. | Energized wires or equipment that could strike head | <input type="checkbox"/> Yes <input type="checkbox"/> No | Hard hat, ANSI Z89, Class G or E (dependent on potential voltage) |
| 4. | Sharp objects or corners at head level | <input type="checkbox"/> Yes <input type="checkbox"/> No | Hard hat, ANSI Z89, Class G, E or C |

Eye Hazards

- | | | | |
|-----|--|--|--|
| 5. | Chemical splashes or irritating mists | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety goggles |
| 6. | Excessive dust | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety glasses or goggles |
| 7. | Smoke and/or fumes | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety goggles |
| 8. | Welding operations | <input type="checkbox"/> Yes <input type="checkbox"/> No | Welding goggles |
| 9. | Lasers/optical radiation | <input type="checkbox"/> Yes <input type="checkbox"/> No | Consult subject matter expert for proper selection |
| 10. | Projectiles | <input type="checkbox"/> Yes <input type="checkbox"/> No | Dual eye protection |
| 11. | Sawing, cutting, chipping, and/or grinding | <input type="checkbox"/> Yes <input type="checkbox"/> No | Dual eye protection |

Face Hazards

- | | | | |
|-----|---------------------------------------|--|-----------------------------------|
| 12. | Chemical splashes or irritating mists | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety goggles |
| 13. | Welding operations | <input type="checkbox"/> Yes <input type="checkbox"/> No | Welding goggles or welding helmet |
| 14. | Projectiles | <input type="checkbox"/> Yes <input type="checkbox"/> No | Dual eye protection |

***If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.
Include any additional guidance in the available section below each item.***

Hand Hazards

- | | | |
|--|--|--|
| 15. Chemical exposure | <input type="checkbox"/> Yes <input type="checkbox"/> No | Use chemical-resistant gloves specific to hazard; consult SDS, subject matter expert, and/or Safety Representative |
| 16. Sharp edges, splinters, etc. | <input type="checkbox"/> Yes <input type="checkbox"/> No | Leather or Kevlar gloves |
| 17. Temperature extremes – heat | <input type="checkbox"/> Yes <input type="checkbox"/> No | Leather gloves, welder's gloves, hot mill gloves |
| 18. Temperature extremes – cold | <input type="checkbox"/> Yes <input type="checkbox"/> No | Insulated gloves |
| 19. Blood, fungus, biological agents | <input type="checkbox"/> Yes <input type="checkbox"/> No | Nitrile gloves |
| 20. Exposure to live electrical currents | <input type="checkbox"/> Yes <input type="checkbox"/> No | Electrical gloves; consult Safety representative |
| 21. Sharp tools, machine parts, etc. | <input type="checkbox"/> Yes <input type="checkbox"/> No | Leather or Kevlar gloves |
| 22. Material handling | <input type="checkbox"/> Yes <input type="checkbox"/> No | Leather, cotton, synthetic gloves |

Foot Hazards

- | | | |
|---|--|---|
| 23. Heavy materials (greater than 50 pounds) handled by employees | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety shoes or boots |
| 24. Potential to crush or cut whole foot | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety shoes or boots with metatarsal guard |
| 25. Sharp edges or points (puncture risk) | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety shoes or boots |
| 26. Exposure to electrical hazards | <input type="checkbox"/> Yes <input type="checkbox"/> No | <p>Safety shoes or boots with:</p> <p>Conductive - Protects the wearer in an environment where the accumulation of static electricity on the body is a hazard.</p> <p>Static dissipative - Reduces accumulation of excess static electricity by conducting body charge to ground while maintaining a sufficiently high level of resistance.</p> <p>Electrical hazard - Provides a secondary source of protection against accidental contact with live electrical circuits, electrically energized conductors, parts or apparatus, and is manufactured with non-conductive electrical shock resistant soles and heels.</p> |

***If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.
Include any additional guidance in the available section below each item.***

- | | | | |
|-----|-------------------------|--|---|
| 27. | Slippery conditions | <input type="checkbox"/> Yes <input type="checkbox"/> No | Rubber-soled boots or grips |
| 28. | Chemical contamination | <input type="checkbox"/> Yes <input type="checkbox"/> No | Rubber, PVC, or polyurethane boots or boot covers with puncture and protective toe if task required |
| 29. | Wet conditions | <input type="checkbox"/> Yes <input type="checkbox"/> No | Rubber boots or boot covers |
| 30. | Construction/demolition | <input type="checkbox"/> Yes <input type="checkbox"/> No | Safety boots with metatarsal guard if foot-crushing hazard exists |

Fall Hazards

- | | | | |
|-----|---|--|---------------------------------------|
| 31. | Elevations above 4 feet (general industry) or 6 feet (construction) without guardrails | <input type="checkbox"/> Yes <input type="checkbox"/> No | ANSI A-10.14 Type 1 full-body harness |
| 32. | Suspended scaffolds, boatswain's chairs, float scaffolds, or suspended staging | <input type="checkbox"/> Yes <input type="checkbox"/> No | ANSI A-10.14 Type 1 full-body harness |
| 33. | Working in trees | <input type="checkbox"/> Yes <input type="checkbox"/> No | ANSI A-10.14 Type 1 full-body harness |
| 34. | Working in vehicle-mounted elevating work platforms (e.g., bucket trucks, aerial lifts) | <input type="checkbox"/> Yes <input type="checkbox"/> No | ANSI A-10.14 Type 1 full-body harness |

Water Hazards

- | | | | |
|-----|--|--|--|
| 35. | Working on or above water where a risk of drowning exist | <input type="checkbox"/> Yes <input type="checkbox"/> No | U.S. Coast Guard approved personal floatation device; Type I, II, or III |
|-----|--|--|--|

Excessive Heat or Flame

- | | | | |
|-----|---|--|--|
| 36. | Full body chemical protective clothing in temperatures greater than 80 °F | <input type="checkbox"/> Yes <input type="checkbox"/> No | Cooling vest |
| 37. | Work around molten metal or flame | <input type="checkbox"/> Yes <input type="checkbox"/> No | Nomex or heat reflective clothing |
| 38. | Welding activities | <input type="checkbox"/> Yes <input type="checkbox"/> No | Welding leathers for those areas that are exposed to flame, spark, or molten metal |

Respiratory Hazards

- | | | | |
|-----|---|--|---|
| 39. | Airborne particulates, gases, vapors, or mists in excess of established exposure limits | <input type="checkbox"/> Yes <input type="checkbox"/> No | Refer to <i>S3AM-123-PR1 Respiratory Protection</i> for respirator selection guidance |
|-----|---|--|---|

Excessive Noise

- | | | | |
|-----|-------------------|--|--------------------------|
| 40. | Exposure to noise | <input type="checkbox"/> Yes <input type="checkbox"/> No | Ear plugs, muffs or both |
|-----|-------------------|--|--------------------------|

***If any of the indicated hazards are present, eliminate the hazard or use the indicated PPE.
Include any additional guidance in the available section below each item.***

Body and Leg Protection

- | | | |
|--|--|---|
| 41. Chemical exposure | <input type="checkbox"/> Yes <input type="checkbox"/> No | Contact SH&E Representative and/or subject matter expert for assistance in proper selection |
| 42. Using chainsaw, cutting brush | <input type="checkbox"/> Yes <input type="checkbox"/> No | Chainsaw chaps |
| 43. Exposure to snakes | <input type="checkbox"/> Yes <input type="checkbox"/> No | Snake chaps |
| 44. Exposure to vehicle traffic or heavy equipment | <input type="checkbox"/> Yes <input type="checkbox"/> No | High visibility apparel |

I certify that the above inspection was performed to the best of my knowledge and ability, based on the hazards present on: _____

Name _____ Signature _____

This document should be included in the location specific SH&E Plan.

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Personal Protective Equipment Inspection

S3AM-208-FM2

Name of Inspector _____ Date Inspected _____

Hard Hats – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
1. The brim or shell does not show signs of exposure and excessive wear, loss of surface gloss, chalking, or flaking.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
2. Suspension system in hard hat does not show signs of deterioration, including cracking, tearing, or fraying.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
3. The brim or shell is not cracked, perforated, or deformed.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
4. Employees use hard hats in marked areas.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
5. Areas requiring hard hat usage are marked.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Foot Protection – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
6. Safety shoes used by employees do not show signs of excessive wear.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
7. Areas requiring safety shoes are marked.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Hand Protection – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
8. Gloves are available and worn when needed.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
9. Gloves are appropriate for the task.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
10. Gloves do not show signs of excessive wear such as cracks, scrapes, or lacerations, thinning or discoloration, or break-through to the skin.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Protective Clothing – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
11. Protective clothing (e.g. high visibility apparel, fire resistant clothing) is worn by employees when required.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Hearing Protection – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
12. Noise hazard areas are posted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
13. Employees are using earplugs or muffs when using noise producing equipment or working in posted noise hazard areas.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
Eye and Face Protection – adequate to the hazards? <input type="checkbox"/> Yes <input type="checkbox"/> No Comments:	
14. Eye hazard areas are marked or posted.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
15. Employees use safety glasses/goggles when working in eye hazard areas or working with equipment that produces an eye hazard.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
16. Face shields are used when required and worn over safety goggles.	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A

REMARKS (All “No” answers indicate a hazard which needs to be fixed.)

Americas

Pre-Job Hazard Assessment

S3AM-209-FM4

Location: [Click here to enter text.](#)

Date: [Click here to enter text.](#)

Prepared By: [Click here to enter text.](#)

Approved By: [Click here to enter text.](#)

Principal Activities	Potential Safety/Health Hazards	Initial Risk Rating	Control Measures	Final Risk Rating
List principal activities involved in the scope of work	Identify each safety or health hazard		Identify elimination, substitution, engineering & administrative controls & any specific required PPE	
ACTIVITY 1 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 2 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 3 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 4 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 5 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#

Principal Activities	Potential Safety/Health Hazards	Initial Risk Rating	Control Measures	Final Risk Rating
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 6 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 7 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 8 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
ACTIVITY 9 – Click here to enter text.	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#
	Click here to enter text.	#	Click here to enter text.	#

SPECIAL REQUIREMENTS

Step #	Equipment to be Used	Inspection requirements	Training Requirements
	List equipment to be used in work activity	List inspection/permit requirements for work activity	List training requirements including hazard communication
1.	Click here to enter text.	Click here to enter text.	Click here to enter text.
2.	Click here to enter text.	Click here to enter text.	Click here to enter text.
3.	Click here to enter text.	Click here to enter text.	Click here to enter text.
4.	Click here to enter text.	Click here to enter text.	Click here to enter text.
5.	Click here to enter text.	Click here to enter text.	Click here to enter text.
6.	Click here to enter text.	Click here to enter text.	Click here to enter text.
7.	Click here to enter text.	Click here to enter text.	Click here to enter text.
8.	Click here to enter text.	Click here to enter text.	Click here to enter text.
9.	Click here to enter text.	Click here to enter text.	Click here to enter text.

INSTRUCTIONS AND RISK MATRIX

Hazard Evaluation – Identify principal steps of the task. Identify potential safety/health hazards for each step and determine initial risk rating using the matrix provided below. Identify control measures including PPE for each hazard. Re-evaluate hazard potential and assign a final risk rating. If the final risk rating is a 5-9 (medium risk) or 10-25 (high risk), additional hazard controls shall be identified and applied until the final risk rating is reduced to 4 or below. The final risk rating cannot be reduced to 4 or lower, additional approvals are needed before the activity can begin. Add additional rows as required to cover all major steps/aspects of the activity.

Special Requirements – Identify equipment to be used including specific PPE required. Identify inspection requirements such as competent person, permit issue, documented task hazard analysis, etc. Identify training requirements such as hazard communication, scaffold user, fall protection, etc.

		High ←————→ Low				
High ↑ ↓ Low	Probability	Severity				
		5 - Catastrophic	4 - Critical	3 - Major	2 - Moderate	1 - Minor
	5 - Frequent	25	20	15	10	5
	4 - Probable	20	16	12	8	4
	3 - Occasional	15	12	9	6	3
	2 - Remote	10	8	6	4	2
	1 - Improbable	5	4	3	2	1
10-25 (red) are high risk, 5-9 (yellow) are medium risk, and 1-4 (green) are low risk						

Severity – Potential Consequences				
	People	Property Damage	Environmental Impact	Public Image/Reputation
Catastrophic	Fatality, Multiple Major Incidents	>\$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>\$250K to \$1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost/Restricted Work	> \$10K to \$250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> \$1K to \$10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	<=\$1K USD	Small chemical release contained onsite	Individual complaint

Probability		
Frequent	Expected to occur during task/activity	9/10
Probable	Likely to occur during task/activity	1/10
Occasional	May occur during the task/activity	1/100
Remote	Unlikely to occur during task/activity	1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity	1/10,000

Risk Rating (Probability x Severity)	Risk Acceptance Authority
1 to 4 (Low)	Risk is tolerable, manage at local level
5 to 9 (Medium)	Risk requires approval by Operations Lead/Supervisor & SH&E Manager
10 to 25 (High)	Risk requires the approval of the Operations Manager & SH&E Director

Americas

Daily Tailgate Meeting

S3AM-209-FM5

Instructions: Conduct meeting prior to sending crews to individual tasks. Require attendance of all AECOM employees and subcontractors. Invite personnel from simultaneous operations for coordination purposes. Review scope of work and briefly discuss required and applicable topics. **This meeting is a daily refresher, not a full orientation.** Task-specific discussions associated with Task Hazard Assessment (THA) follow this meeting at the task location immediately before individual task is started.

AECOM Supervisor Name:

Phone Number:

AECOM SH&E Rep. Name:

Phone Number:

Meeting Leader:

Date:	Project Name/Location:	Project Number:	
Today's Scope of Work:			
Muster Point Location:	First Aid Kit Location:	Fire Extinguisher Location:	Spill Kit Location:
1. Required Topics		2. Discuss if Applicable to Today's Work	
<p>Fitness for Duty requirements, all sign in / sign out</p> <p>Required training (incl. task specific) completed and current</p> <p>SH&E Plan onsite - understood, reviewed, signed by all (incl. scope, hazards, controls, procedures, requirements, etc.)</p> <p>Pre-Job Hazard Assessments (JHA/JSAs) available and understood</p> <p>Task Hazard Assessments (THAs) are to be completed for each task immediately prior to conducting</p> <p>STOP WORK Right & Responsibility- all task changes/changed conditions re-assess with THA</p> <p>Requirement to report to supervisor any injury, illness, damage, near miss, unsafe act / condition</p> <p>Emergency Response Plan – including muster point, first aid kit, fire extinguisher, clinic/hospital location</p> <p>Personal Protective Equipment (PPE) - Required items per hazard assessments in good condition / in use by all</p> <p>Equipment/machinery inspected (documented as required) and in good condition - operators properly trained/certified</p> <p>Work area set up and demarcation/ barricades in place to protect workers, site staff, and the public</p> <p>Required checklists/records available, understood (describe):</p> <p>Lessons Learned / SH&E improvements (describe):</p>		<p>Check <input checked="" type="checkbox"/> as reviewed or mark <input type="checkbox"/> as not applicable</p> <p>Biological/ Chemical / Electrical Hazards</p> <p>Ergonomics - Lifting, Body Position</p> <p>Lock Out/ Tag Out</p> <p>Short Service Employees - visual identifier and mentor/ oversight assignment</p> <p>Simultaneous/ Neighbouring Operations</p> <p>Slip/ Trip/ Fall Hazards</p> <p>Specialized PPE Needs</p> <p>Traffic Control</p> <p>Waste Management/ Decontamination</p> <p>Weather Hazards / Heat Stress / Cold Stress</p> <p>Subcontractor Requirements (e.g., JHAs, THAs, procedures, reporting, etc.)</p> <p>Work Permits / Plans required (e.g., Fall Protection, Confined Space, Hot Work, Critical Lifts, etc.); in place, understood (identify/attach):</p> <p>Other Topics (describe/attach):</p> <p>Client specific requirements (describe):</p>	
3. Daily Check Out by Site Supervisor			
Describe incidents, near misses, observations or Stop Work interventions from today:		Describe Lessons Learned/ Improvement Areas from today:	
<i>The site is being left in a safe condition and work crew checked out as fit unless otherwise specified as above.</i>			
Site Supervisor Name	Signature	Date Time (at end of day / shift)	

Worker Acknowledgement / Sign In Sign Out sheets applicable to this meeting are on reverse and, if applicable, attached.

Daily Tailgate Meeting (S3AM-209-FM5)

Revision 7 December 27, 2017

PRINTED COPIES ARE UNCONTROLLED. CONTROLLED COPY IS AVAILABLE ON COMPANY INTRANET.

All employees:

- **STOP WORK** if concerned / uncertain about safety / hazard or additional precaution is not recorded on the THA.
- **Be alert and communicate any changes in personnel or conditions at the worksite to the supervisor.**
- **Reassess task, hazards, & mitigations on an ongoing basis; amend the THA if needed.**

SITE WORKERS (including AECOM Contractors and Subcontractors): Your signature below means that you understand:

- * The requirement to participate in creating, reviewing, & updating hazard assessments (THA) applicable to your task(s).
- * The hazards & control measures associated with each task you are about to perform.
- * The permit to work requirements applicable to the work you are about to perform (if it includes permitted activities).
- * That no tasks or work is to be performed without a hazard assessment.
- * Your authority & obligation to "Stop Work" intervene, speak up/ listen up.

Your initials (right columns) certify that you arrived & departed fit for duty, & have reported all incidents/near misses; meaning:

- * You are physically and mentally fit for duty and have inspected your required PPE to ensure satisfactory condition.
- * You are not under the influence of any type of medication, drugs, or alcohol that could affect your ability to work safely.
- * You are aware of your responsibility to immediately report any illness, injury (regardless of where or when it occurred), or impairment/fatigue issue to the AECOM Supervisor.
- * You signed out as fit / uninjured unless you have otherwise informed the AECOM Supervisor.

Print Name & Company	Signature	Initials & Sign In Time	Initials & Sign Out Time
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit
		In & Fit	Out & Fit

(Attach additional Site Worker sign-in/out sheets if needed) Identify number of attached sheets: _____

SITE VISITOR / SITE REPRESENTATIVE

Name	Company Name	Arrival Time	Departure Time	Signature

S3AM-209-FM6

Date:	Project Name / Location:		
Permit / Job Number:		Project Number:	
Description of Task:			

Do you have a pre-job hazard assessment (JHA) specific to this task in your hands?

Yes – review the steps, hazards, and precautions. Attach and reference JHA in the form below. Add any additional steps, hazards, and precautions to this form otherwise unidentified on JHA.

No – list all steps, hazards, and precautions associated with the task in the form below.

Basic Task Steps	Hazards	Risk	Control Measures / Precautions	Risk	Revised?
(explain in order how the task will be carried out)	(identify all hazards & potential hazards of each step)	(before)	(describe how that hazard will be controlled)	(after)	(yes – record time)
			Highest Risk Index		

The Task Hazard Assessment is to be completed at the worksite by the individual(s) who is intended to conduct the task immediately prior to initiating the associated task. Number and attach additional pages if necessary.

Originator

Print Name

Signature

Worker/Visitor acknowledgement and review of this content on back of this document. Originator to also sign Worker acknowledgement section.

Supervisor

Print Name

Signature _____

Risk Matrix on Reverse

THIS FORM IS TO BE KEPT ON JOB SITE.

WORKER SIGN ON

NAME (Please Print) TIME SIGNATURE

I participated in the development and understand the content of this Task Hazard Assessment.

Task Hazard Assessment Follow-Up/Review

Initials/Time Initials/Time Initials/Time

Instructions:

Identify basic steps of the task and associated hazards. Calculate the initial risk rating. Identify control measure to eliminate or reduce the hazard's risk and calculate the residual risk rating. If the risk rating (after controls are implemented) cannot be reduced to 4 or lower, additional approvals are needed before the activity can begin.

Employees shall monitor the activities for compliance with this document. Workers should **STOP WORK** on a task if conditions change from the planned and agreed approach to the work.

This document should be updated to reflect new conditions or changes in task methods.

VISITOR SIGN ON

I have read and understand the content of this Task Hazard Assessment.

Emergency Meeting / Assembly Area

--

Emergency Contact

--

Method of Communication

--

Risk Rating Matrix

Probability	Severity				
	5 - Catastrophic	4 - Critical	3 - Major	2 - Moderate	1 - Minor
5 - Frequent	25	20	15	10	5
4 - Probable	20	16	12	8	4
3 - Occasional	15	12	9	6	3
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10 to 25 (High)	Risk requires the approval of the Operations Manager & SH&E Director

Severity – Potential Consequences				
	People	Property Damage	Environmental Impact	Public Image/Reputation
Catastrophic	Fatality, Multiple Major Incidents	>\$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>\$250K to \$1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost/Restricted Work	> \$10K to \$250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> \$1K to \$10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	<= \$1K USD	Small chemical release contained onsite	Individual complaint
Probability				
Frequent	Expected to occur during task/activity			9/10
Probable	Likely to occur during task/activity			1/10
Occasional	May occur during the task/activity			1/100
Remote	Unlikely to occur during task/activity			1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity			1/10,000

Use this checklist when conducting site safety inspections to determine compliance with the AECOM Safety, Health and Environment Safety Management System.

Item	Yes	No	N/A	Comments
1. Documentation and Communication				
a. Site office has a Safety Bulletin Board prominently located / organized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Site-specific SH&E plan on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Appropriate jurisdiction's regulations available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. AECOM SH&E policy and procedures readily available on- site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Daily tailgate safety meetings performed and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Client issued or required documentation available and complete?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Does SH&E documentation (SH&E Plans, Tailgate Meetings) reflect coordination with clients or those conducting concurrent operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Personnel medical monitoring information up to date as applicable?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Are Authorized Drivers identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Are safety metrics reported, maintained and posted (e.g. OSHA 300 log) as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Are Behavior-Based Safety observations documented and appropriately submitted (e.g., LifeGuard, IndustrySafe, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Are subcontractors pre-qualified and documented as included in communications (e.g. Tailgate Meetings, ERP, orientations, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Emergency Response Plan				
a. Is the Location Specific Emergency Response Plan (ERP) current (reviewed at a minimum annually), in place and posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Have personnel been trained in the ERP procedure, and drills been conducted and documented in accordance with the SH&E Plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are evacuation routes / muster points appropriately located and clearly identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are adequate emergency response supplies available as applicable to the potential emergencies (e.g., stretcher, spill kit, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are there plans in place to identify special needs evacuees to ensure their exit during emergencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Do employees who remain to operate critical operations before they evacuate know the proper procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Is the employee alarm system that provides a warning for emergency action recognizable and perceptible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Do employees know their responsibilities for reporting emergencies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Have visitors signed any required documentation (e.g. Tailgate Meeting, THA, etc.) and are they accompanied by an AECOM employee?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Hazard-specific Documentation				
a. Task Hazard Assessment completed prior to work commencing and as new hazards are identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Hazardous substance exposure sampling documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Hot work permits completed, signed and posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Lockout/Tagout procedures implemented and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Confined Space procedures implemented and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Utility Clearance procedures implemented and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
4. Incident Reporting, Notifications & Investigation				
a. Are incidents, including near misses, reported to Supervisor and/or SH&E Manager and documented in the on-line incident management system (e.g. IndustrySafe)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are incident investigations completed as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Is a root cause analysis performed (e.g. Why Tree, 5 Why, TapRoot)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are corrective actions entered into in the on-line incident management system (e.g. IndustrySafe) and tracked to completion?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Has post-injury management been effective?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Training				
a. Site specific safety orientations provided to staff and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Have visitors completed site specific safety orientations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Site/task specific SH&E personnel training documented/available in LMS?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are workers adequately trained for the tasks at hand (e.g. forklift, respirator use, fall protection, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Do workers have documentation verifying current and applicable training (e.g. certificates, tickets, licenses, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are Competent Persons identified and designated for the applicable operations conducted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are SH&E communications and any regulatory (e.g. OSHA) posters displayed in an area where all employees are likely to see them?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Housekeeping				
a. Drinking water containers and potable water provided and labelled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Adequate waste receptacles provided and waste routinely removed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are break /lunch areas clean/sanitary and appropriately separated from toilet or janitorial areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are toilet facilities adequate and clean?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Walkways, corridors and work areas kept clear of trash and debris?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Is lighting adequate in passageways, stairways, and work areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Unused materials, equipment and tools appropriately stored?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Are temporary sleeping quarters heated, ventilated, and lighted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Personal Protective Equipment (PPE)				
a. Are PPE requirements identified in the Health and Safety Plan and Task Hazard Assessments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Is PPE used as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Safety boots?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ii. Hard hats?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iii. Reflective vests?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iv. Safety glasses?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
v. Respiratory protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
vi. Hearing protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
vii. Fall protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
viii. Hand protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ix. Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
c. Is PPE adequate to the hazards identified?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. PPE properly stored, maintained and clean?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. PPE in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Personnel instructed on use and care of PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
8. Fire Protection				
a. Are "No Smoking" or "Flammable" signs posted at all storage or fueling facilities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are suitable fire extinguishers (type and size) provided, marked and placed as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Fire extinguishers accessible, properly working and fully charged?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Fire extinguishers inspected in the last month?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are flammable liquids stored in approved containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are large fuel tanks properly diked and separated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
9. First Aid				
a. First Aid trained personnel on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Names of First Aid Personnel posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. First aid supplies appropriate and suitable to the number of workers and potential hazards and available at suitable locations on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are first aid kits inspected monthly and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
10. Hazardous Materials				
a. Materials in storage kept in safe condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Is there an inventory of the hazardous materials present and the associated Safety Data Sheets (SDS) readily available and up to date?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Hazardous materials properly labelled?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are procedures followed when handling hazardous materials?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are gas cylinders in safe condition, properly segregated, secured upright, and capped when not in use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are explosives being used, stored and transported in compliance with regulations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Hazard Communications/WHMIS training complete?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Are significant quantities of highly hazardous chemicals, or flammable liquids, or gases in excess of 10,000 pounds, in proximity to AECOM's work areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. If yes, have AECOM employees been provided Process Safety Management (PSM) training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ii. Has the training been documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<p align="center">The following may or may not be present on the worksite. Please obtain assistance from an experienced individual to complete these sections if necessary.</p>				
Item	Yes	No	N/A	Comments
11. Welding and cutting on site?				
a. Is the eye protection proper for the welding or cutting application?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are gauges, valves, torches, and lines in good condition, clean, and free of oil and grease?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are cylinders not in use capped and properly stowed and segregated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
d. Are cylinders in use or stored secured in an upright position?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are there anti-flashback valves at the cylinders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Is there a fire extinguisher near each welding or cutting operation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Is there adequate ventilation in the areas of welding or cutting?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Is the arc-welding machine properly grounded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Is medical surveillance required for workers (e.g., lead or asbestos exposure) properly maintained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Are all parts of the arc-welding outfits properly insulated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Is appropriate combustible gas indicator air monitoring conducted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Is the Hot Work Permit completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
m. Are personnel wearing appropriate fire-resistant clothing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Heavy Equipment and Powered Industrial Trucks?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Proper warning signs and barricades in place?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. AECOM employees are operating equipment properly trained (e.g. Excavator operation, Forklift operation, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Equipment safely operated according to procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Equipment properly inspected (inspection reviewed) and maintained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Is dust control required and properly performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Does equipment that is parked or unattended have all implements lowered to the ground?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are ground personnel working with the Equipment Operator properly located and provided with adequate communication means and PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
13. Drill rigs on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Are drill rig masts and structures at least 20 feet (6.1 meters) from power lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are rigs inspected daily and are inspections documented and available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Is the rig "kill" switch operational?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Is the work area clear of debris?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are wire rope, hydraulics, controls, and mechanical apparatus in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are workers trained in the use of power tools? Is this documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Have proper underground utility clearances been obtained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Have overhead utility clearances been considered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Are flammable liquids in approved containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Is the emergency rig shutoff within reach of the operator?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Is the drilling platform properly stabilized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Are ropes and chains in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14. Cranes on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Is the Crane Operator certified as "Qualified" ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are crane inspections and certifications completed and documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are critical lifts (e.g., >75% rated capacity, personnel lifts, lifts over utilities, etc.) conducted according to procedure?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Does the Operator complete a daily inspection and test? Documented?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
e. Are crane masts and booms located at least 20 feet (6.1 meters) away from power lines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Is the annual inspection current? Is documentation present with the crane?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are cables inspected and in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Is rigging inspected and in good condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Is rigging of loads performed in accordance AECOM procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Do employees remain clear of suspended or swinging loads?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Are tag lines used to control suspended loads?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Has the operator provided for rear swing protection and pinch point guarding?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
m. Are exposed belts and pulleys properly guarded?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
n. Are the following properly installed/posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iii. Fire extinguisher	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iv. Boom -angle indicator	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
v. Load capacity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
vi. Hand-signal poster	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
o. Are signs (e.g. "Wide Load") and/or flags properly displayed on the crane while in transit?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
p. Are Crane Suspended Personnel Platform (Manbaskets) used in compliance with AECOM procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
q. Are employees a minimum of 2 pile lengths from where piles are being cut and dropped?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
15. Fall Protection present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Is fall protection in place to address falls > 6 feet (1.8m) (construction activities), >4 feet (1.2m) for all other activities, or as per jurisdiction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are workers properly trained in fall protection hazards and procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Is a Fall Protection Plan developed when passive fall protection controls are impractical?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Is an Alternative Fall Protection Permit completed when required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are personal fall arrest systems properly designed, with acceptable anchorage point?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are harnesses (no body belts) and lanyards properly maintained, inspected, and worn?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are guardrails constructed properly (with toprail, midrail and toeboard at appropriate heights and of required strength)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Are floor openings provided with guard rails or adequately covered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Are there standing guard rails on scaffolds, bridge decks, floors of buildings, work platforms, and walkways?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Is protection provided over rebar when workers are working above (e.g. rebar caps)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Are stairways provided with handrails?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Confined Spaces present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Has the location been surveyed to identify and, as applicable, designate confined spaces (e.g. permit, non-permit, high hazard, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Employees who enter or monitor confined spaces have required training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Confined spaces identified and posted?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
d. Confined space hazard assessment forms completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Confined space entry permits properly completed, signed and immediately available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are rescue personnel available, trained and properly equipped?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Tools, equipment or machines present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Are damaged or broken tools, equipment and machines tagged out of service?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Is storage space adequate for tools, equipment and machines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. The tools and equipment appropriate to the job and properly used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. All required guards in place on the tools, equipment and machines?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. All tools, including electrical and pneumatic tools, in safe condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Electrical cables and hoses in good condition and out of the way?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are extension cords tested for assured ground?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Are air hose couplers properly secured (e.g. whip checks)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Personnel using tools, equipment and machines properly trained?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Electrical present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Electrical installations in a safe condition?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Equipment grounded as required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are GFCIs in use for all portable equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Has the grounding circuit been tested?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Panels, disconnects or breakers covered and clear access provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Lock out/tag outs used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Live circuits protected from worker contact?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. If potentially explosive atmospheres exist, is the electrical equipment intrinsically safe?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Scaffolds present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Scaffolds erected by a qualified individual?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are scaffolds properly braced, anchored, and plumb?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Handrails, mid-rails, and toe-boards in place?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Platforms fully planked and secured?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Screens installed where personnel are required to work/walk below?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Scaffold parts in safe condition, free from damage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Mobile scaffold wheels locked when the scaffold is used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Proper fall protection used when guardrails are not used?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
20. Floors, Wall Openings and Stairways present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Barricades placed to guard all floor and wall openings that are 4 feet (1.2m) or more above the lower level?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. All floor openings covered, secured and marked?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Handrail provided for stairs having more than 4 risers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. No materials stored within 6 feet of floor or wall openings?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
e. Stairways kept clear of trash, obstructions and tripping hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
21. Ladders present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Ladders stored properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are ladders properly rated and of appropriate capacity for the task and hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Ladders, including stepladders, used safely?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Straight ladders angled properly and tied in or secured?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Ladders extend a minimum of 36 inches (1m) above level of access?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Job made ladders constructed properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
22. Excavation and Trenching present on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Underground utilities have been identified, marked, protected AND verified before digging?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Has appropriate documentation been completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. All trenches/excavations supervised by a competent person?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. All trenches/excavations inspected daily by a competent person?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Equipment or materials stored no closer than 5 feet (1.5m) from edge of excavation/ trench?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Spoils no closer than 2 feet (0.6m) from edge of excavation/ trench?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are support systems (e.g. piling, cribbing, shoring) appropriate for the job (e.g. stress due to adjacent structures, vibration from traffic, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Is the trench or excavation protected from traffic or equipment (stop logs or other barriers)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Excavations requiring employee entry appropriately sloped or benched and/or shoring/ boxes provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Excavations properly barricaded and/or identified with signage, barrier tape, warning lights or fencing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Safe access and exit provided?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Is the air tested prior to entry for O ₂ , CO, H ₂ S, and LEL as appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
m. Is the trench adequately ventilated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
n. Is there suitable access by stairs, ladders, ramps, hoists?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
o. Ladders for egress placed no greater than 25 feet (7.6m) from workers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
23. Exposure Monitoring required?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Is health and safety instrumentation available and in use per the safety plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are air monitoring instrumentation maintenance and calibration logs available and current?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Is air monitoring performed every time a different operation is initiated?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Is air monitoring performed when personnel are working in an area with obvious liquid contamination?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Is air monitoring performed any time that new contaminants are encountered that differ from those initially encountered?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Is air monitoring performed any time new work begins on a different portion of the site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Is the air monitoring log available and current?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Does the monitoring log reflect excursions above action levels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Has personal sampling been performed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
j. Have any exposure symptoms been reported?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Is the appropriate respiratory protection available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
l. Have personnel received a medical clearance and been fit-tested prior to respirator use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
m. Is heat stress monitoring conducted and appropriate actions taken (e.g. work to rest schedules established)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
n. Is cold stress monitoring conducted and appropriate actions taken (e.g. work to rest schedules established)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
24. Noise				
a. Are noise sources identified and subsequently eliminated or reduced where possible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. If noise levels exceed 85 decibels, is a hearing protection program available?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. If noise levels may exceed 85 decibels, is hearing protection worn by personnel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Is audiometric testing available to employees whose exposures equal or exceed an 8-hour time-weighted average of 85 decibels?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
25. Traffic control required on site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
a. Are appropriate traffic control elements in place (e.g. barricades, flag person, road identifiers, speed limit signs, etc.)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are the advance signage and approaches to work area adequate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are the flag persons properly trained, dressed, and equipped?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are the flag persons performing properly?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Are both traffic and ground personnel complying with the traffic control requirements?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
26. Hazardous Waste Operations – Site Control				
a. Site Safety Officer appointed / present?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Site security and control measures evident in the field?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Site work zones clearly defined on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Communication systems (walkie-talkies, air horns) to alert personnel in the event of a site evacuation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Is at least 1 person on site at all times current with CPR and First Aid training?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Route to the nearest comprehensive medical treatment facility available to personnel?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Emergency phone numbers conspicuously posted at site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
27. Hazardous Waste Operations - Training				
a. Documentation of initial health and safety training (e.g. 40-hour)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Documentation of on-the-job training as required (e.g. 29 CFR 1910.120(e))?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Documentation of annual health and safety refresher training (as applicable) (e.g. 8-hour)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Documentation of additional training relating to site operations for on-site managers and supervisors directly responsible for supervision of personnel engaged in hazardous waste operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Documentation of DOT/Hazardous Materials Shipping training (as applicable)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Documentation of training received in the following elements of the site-specific health and safety plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Site control measures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
ii. Chemical hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iii. Decontamination procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
iv. Physical hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
v. Emergency response plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
vi. Location of SDSs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
vii. Confined-space-entry procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
viii. Location of emergency equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
ix. Spill containment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
x. Use, maintenance, and storage of PPE?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
28. Hazardous Waste Operations – Drum Handling Procedures				
a. Are drums and containers used for the clean-up on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. If yes, do the drums meet appropriate DOT, OSHA, and EPA regulations (or jurisdictional equivalent) for the wastes they contain?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are all drums and containers inspected for structural integrity before moving?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are personnel warned of the potential hazards associated with the contents of drums or containers prior to movement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are drums moved using appropriate mechanical devices to avoid injury?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Is there a potential for a major spill during transfer of drums or containers?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. If yes, is there a spill containment program in place to contain and isolate the entire volume of the spill?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
29. Hazardous Waste Operations – Drums of Unknown Content				
a. Is a detection system being used to estimate location and depth of drums and containers on site prior to excavation activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Are drums or containers being handled on-site?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. If yes, is a fire extinguisher on site during any drum- or container-moving operation in the event of a fire?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Does an instructional program for personnel detail procedures for drum or container-opening operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Are only required personnel present during drum or container openings and are other personnel at a safe distance from the operation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
e. Does an instructional program for personnel indicate either that drum openings will occur remotely with pressure relief or that an appropriate shield will be placed between personnel and the drum container during opening?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are personnel informed not to stand upon or work in proximity to drums (except when the task requires this)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Are sampling procedures for drums, tanks, containers, vaults, etc., appropriately documented and available to personnel for review as part of a field sampling plan?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
30. Hazardous Waste Operations – Decontamination				
a. Are decontamination areas situated to minimize contamination potential of uncontaminated personnel or equipment?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
b. Does the site safety and health supervisor monitor decontamination procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
c. Are applicable decontamination procedures observed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
d. Do established equipment drop-off decontamination and protective clothing doffing procedures minimize personnel exposures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Item	Yes	No	N/A	Comments
e. Are personnel, clothing, and equipment decontaminated properly prior to leaving a contaminated area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
f. Are protective clothing and equipment decontaminated, cleaned, laundered, maintained, or replaced as needed to maintain effectiveness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
g. Is the proper order of PPE removal observed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
h. Where decontamination procedures indicate a need for showers and change rooms, are soap, hot and cold water, individual clean towels, and separate storage facilities for street and work clothes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
i. Are unauthorized personnel (e.g. administrative and support staff) denied access to decontamination areas, decontamination equipment, and change rooms?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
j. Are washing facilities away from hazardous substances and adequate to permit personnel to remove hazardous substances from their bodies?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
k. Are decontamination solution(s), equipment, and clothing properly marked and left on-site or disposed of?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

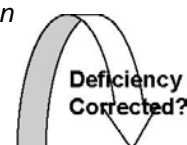
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Equipment Checklist

S3NA-306-FM1

Name of Contractor (or N/A): _____ Project Name: _____
 Location: _____ Project #: _____
 Date: _____ Time: _____ Weather: _____
 Person Conducting Inspection _____ Title: _____

*Note: As you conduct your inspection you should be able to answer each question with a **YES**. If the answer to any question is **NO**, this deficiency should be corrected as soon as possible.*



	YES	NO	OK	N/A
Are accident prevention signs, tags clearly visible?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are danger signs used where immediate hazards exist?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are caution signs used to warn against potential hazards or to caution against unsafe practices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are exit signs posted at all exit locations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are proper visual warning signs posted prior to (in advance of) the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers provided with signs, signals, and barricades to provide the necessary protection?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers using red lights when signaling during periods of darkness?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are flaggers wearing highly visible warning garments?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are the flaggers trained in proper flagging procedures?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are warning garments worn at night reflectorized?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are highly visible flags used by the flaggers at least 18 inches (45 centimeters) square?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are barricades used to totally obstruct the passage of people and vehicles to protect the work area?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Do barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

COMMENTS:

Heavy Equipment Inspection Report

S3NA-309-FM13

[illegible]

1.0 Types of Safety Knives or Alternative Cutting Tools

1.1 Self-retracting utility knives (brands – OLFA, Martor, Allway Tools)



1.2 Guarded utility knives (brands – The Safety Knife Co., Martor)



1.3 Shears, snips, scissors (brands – Ridgid, Craftsman, Wolfcraft)



1.4 Concealed blade cutters (brands – The Safety Knife Co., Martor)



1.5 Pipe cutters (brands – Ridgid, Empire)



1.6 Specialty cutter (brand – Geoprobe)



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Glove Needs Assessment

S3NA-317-FM1

Mgr. / Supervisor Name:

Work Area Name:

Task/Operation Being Evaluated:

Date:

1.0 Using the Protection and Performance Needs Assessment Table Below

- 1.1 Function and performance needs must be evaluated thoroughly. If employees have a strong need for dexterity, tactility, and/or grip this should be identified as a priority. Rank properties in the table below with 1 being the highest priority. Do not assign the same priority more than once. It is only necessary to rank the applicable properties. If all properties are ranked, the lowest priority would be ranked 12.

Protection and Performance Needs Assessment			
Category	Properties	Protection and Performance Needs	Priority (1=Top Priority)
Mechanical	Cut Resistance	Protection from sharp edges, blades, and other cutting hazards	
	Puncture Resistance	Protection from sharp objects like nails, pins, needles, wire	
	Abrasion Resistance	Durability and resistance to abrasive objects or materials	
	Shielding	Protection from impact, ricochet, small projectiles.	
Chemical	Degradation & Absorption Resistance	Durability and resistance to breaking down and/or permeating the glove from exposure to chemicals. Refer to the chemical's Safety Data Sheet for the appropriate glove choice.	
Thermal	Heat Resistance	Thermal protection from hot objects or materials	
	Cold Resistance	Thermal protection from cold weather, objects, or materials	
Vibration	Anti-Vibration	Vibration reduction from operating certain tools and equipment	
Electrical	Insulation	If performing work on electrical equipment, this must be the top priority	
Function	Dexterity	Ability to manipulate objects and control hands in the desired manner	
	Tactility	Ability to sense objects by touch	
	Grip	Ability to exert pressure on an object when holding it	

- 1.2 Identify a glove that meets the top protection and performance priorities.

In most cases there are trade-offs between hazard protection and functional performance of a glove. These factors are equally important. The higher the severity of the hazard, the more important hazard protection is. The table below offers additional guidance on key considerations when selecting a glove for certain protection and performance properties.

Category	Properties	Key Considerations and Selection Criteria
Mechanical	Cut Resistance	Testing Standard: ASTM F1790 and ASTM F1970-05 There are 5 levels of cut resistance. 5 is the highest.
	Puncture Resistance	Testing Standard: EN 388:2003 This testing measures the force required to pierce the sample with a standard sized point.
	Abrasion Resistance	Testing Standard: ASTM D3389-05 and ASTM D3884-09 Abrasion resistance testing measures how well the glove material resists loss of material from rubbing on rough surfaces.
	Shielding	Some gloves offer thick padding or hard guards around the back of the hand or knuckles. These can offer good protection against impact.
Chemical	Degradation & Absorption Resistance	Identify products / chemicals that present potential exposures. Refer to the chemical's Safety Data Sheet and glove manufacturer's specifications for the appropriate glove choice.
Thermal	Heat Resistance	Testing Standard: ASTM F1060-08 This testing measures the insulation provided by the glove when contacting a hot surface. Higher temperatures reported indicate a glove with greater insulation.
	Cold Resistance	Testing Standard: EN 511:1994 (for ambient temperature) Testing Standard: ISO 5085:1989-1 (for cold surfaces) Choosing the right glove depends on whether protection is needed from cold weather or cold surfaces.
Vibration	Anti-Vibration	Testing Standard: ANSI S2.73-2002 (R2007) This testing method measures the vibration transmission of the glove.
Electrical	Insulation	Testing Standard: ASTM D120-09 Glove protection depends on the maximum voltage of energized components.
		50 – 480V Class 00 with Leather Protectors
		480 – 600V Class 0 with Leather Protectors
		600V and above Class 0 or higher (depending on maximum voltage) with Leather Protectors
Function	Dexterity	Testing Method: EN 420:2003 Ability to manipulate objects and control hands in the desired manner. This testing method assesses the wearer's ability to pick up small diameter pins lying on a flat surface with their thumb and forefinger. If high dexterity is needed, and the hazards are relatively low to the forefinger and thumb, consider a glove that is tip less for those two digits.
	Tactility	Ability to sense objects by touch. There is no standard test. However, a common field test is to determine if the wearer can feel a pulse while wearing the glove. This is affected by the thickness of the glove, presence of liners, glove surface characteristics, and properties of the coating material.
	Grip	Testing Standard: NFPA 1971 (Grip) Ability to exert pressure on an object when holding it.

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Lock & Tag Log

S3NA-325-FM1

Name of Qualified Person: _____ Job Name: _____ Date: _____

Job Description: _____ Job Location: _____

TAG NUMBER	LOCK NUMBER	AUTHORIZED EMPLOYEE	LOCATION USED	COMPONENT AFFECTED	DATE/TIME ATTACHED	DATE/TIME REMOVED

Name of Qualified Person (print) : _____ Signature: _____ Date: _____

Name of Supervisor / Manager (print) : _____ Signature: _____ Date: _____

Lock & Tag Log (S3NA-325-FM1)

Revision 0 March 1, 2016

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Lockout Tagout Permit

S3NA-325-FM4

Equipment/System to be Isolated: _____

Building: _____ Floor: _____ Column: _____

Other Location: _____

Purpose of Isolation: _____

Type of Isolation: _____

Authorized Employee: _____ Date: _____

Special Instructions: _____

Lockout Tag Out Performed: _____

Tag No.	Device ID	Bldg/Floor/Col.	Installed By	Removed By

Verification System Is Safe for Specified Work to Start

Authorized Employee: _____ Date: _____ Time: _____

Accountability**Accepts Protection**

Requesting Authority: _____ Date: _____ Time: _____

Accountability**Release Protection**

Requesting Authority: _____ Date: _____ Time: _____

Lockout/Tag Out Removal Authorization

Authorized Employee: _____ Date: _____ Time: _____

[illegible]

Attachment 5 - Safety Data Sheets



Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909
US GHS

Synonyms: Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

*** Section 1 - Product and Company Identification ***

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

*** Section 2 - Hazards Identification ***

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation – Category 2
Germ Cell Mutagenicity – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Suspected of causing genetic defects.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapours/spray.

Response

In case of fire: Use water spray, fog or foam to extinguish.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.
IF exposed or concerned: Get medical advice/attention.

Storage

Store in a well-ventilated place. Keep cool.
Keep container tightly closed.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO₂, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

*** Section 7 - Handling and Storage ***

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

*** Section 8 - Exposure Controls / Personal Protection ***

Component Exposure Limits

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: 100 mg/m3 TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel)
Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Naphthalene (91-20-3)

ACGIH: 10 ppm TWA
15 ppm STEL

Skin - potential significant contribution to overall exposure by the cutaneous route

OSHA: 10 ppm TWA; 50 mg/m3 TWA

NIOSH: 10 ppm TWA; 50 mg/m3 TWA
15 ppm STEL; 75 mg/m3 STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, straw-yellow.	Odor:	Mild, petroleum distillate odor
Physical State:	Liquid	pH:	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	Vapor Density:	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	Melting Point:	ND
Solubility (H2O):	Negligible	Specific Gravity:	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	VOC:	ND
Percent Volatile:	100%	Octanol/H2O Coeff.:	ND
Flash Point:	>125 °F (>52 °C) minimum	Flash Point Method:	PMCC
Upper Flammability Limit (UFL):	7.5	Lower Flammability Limit (LFL):	0.6
Burning Rate:	ND	Auto Ignition:	494°F (257°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m³ 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Fuels, diesel, no. 2 (68476-34-6)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)

IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

*** Section 12 - Ecological Information ***

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Fuels, diesel, no. 2 (68476-34-6)

Test & Species

96 Hr LC50 Pimephales promelas 35 mg/L [flow-through]

Conditions

Naphthalene (91-20-3)

Test & Species

96 Hr LC50 Pimephales promelas 5.74-6.44 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss 1.6 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss 0.91-2.82 mg/L [static]
96 Hr LC50 Pimephales promelas 1.99 mg/L [static]

Conditions

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** Section 13 - Disposal Considerations ***

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

*** Section 14 - Transportation Information ***

DOT Information

Shipping Name: Diesel Fuel

NA #: 1993 **Hazard Class:** 3 **Packing Group:** III

Placard:



*** Section 15 - Regulatory Information ***

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health
X

Chronic Health
X

Fire
X

Sudden Release of Pressure
--

Reactive
--

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

Additional Regulatory Information

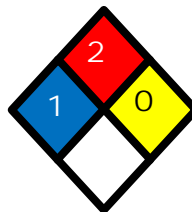
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating

Health 1
Fire 2
Reactivity 0



HMIS® Hazard Rating

Health 1* Slight
Fire 2 Moderate
Physical 0 Minimal
*Chronic

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Material Name: Diesel Fuel, All Types

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Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet



Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950
US GHS

Synonyms: Hess Conventional (Oxygenated and Non-oxygenated) Gasoline; Reformulated Gasoline (RFG); Reformulated Gasoline Blendstock for Oxygenate Blending (RBOB); Unleaded Motor or Automotive Gasoline

*** Section 1 - Product and Company Identification ***

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

*** Section 2 - Hazards Identification ***

GHS Classification:

Flammable Liquid - Category 2
Skin Corrosion/Irritation - Category 2
Germ Cell Mutagenicity - Category 1B
Carcinogenicity - Category 1B
Toxic to Reproduction - Category 1A
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Specific Target Organ Toxicity (Repeat Exposure) - Category 1 (liver, kidneys, bladder, blood, bone marrow, nervous system)
Aspiration Hazard - Category 1
Hazardous to the Aquatic Environment – Acute Hazard - Category 3

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

DANGER

Hazard Statements

Highly flammable liquid and vapour.
Causes skin irritation.
May cause genetic defects.
May cause cancer.
May damage fertility or the unborn child.
May cause respiratory irritation.
May cause drowsiness or dizziness.
Causes damage to organs (liver, kidneys, bladder, blood, bone marrow, nervous system) through prolonged or repeated exposure.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

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Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep container tightly closed.
Ground/bond container and receiving equipment.
Use explosion-proof electrical/ventilating/lighting/equipment.
Use only non-sparking tools.
Take precautionary measures against static discharge.
Wear protective gloves/protective clothing/eye protection/face protection.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe mist/vapours/spray.
Use only outdoors or in well-ventilated area.
Do not eat, drink or smoke when using this product.
Avoid release to the environment.

Response

In case of fire: Use water spray, fog, dry chemical fire extinguishers or hand held fire extinguisher.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash before reuse. If skin irritation occurs, get medical advice/attention.
IF exposed or concerned: Get medical advice/attention.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a poison center or doctor/physician if you feel unwell.
Get medical advice/attention if you feel unwell.
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do not induce vomiting.

Storage

Store in a well-ventilated place.
Keep cool. Keep container tightly closed.
Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
86290-81-5	Gasoline, motor fuel	100
108-88-3	Toluene	1-25
106-97-8	Butane	<10
1330-20-7	Xylenes (o-, m-, p- isomers)	1-15
95-63-6	Benzene, 1,2,4-trimethyl-	<6
64-17-5	Ethyl alcohol	0-10
100-41-4	Ethylbenzene	<3
71-43-2	Benzene	0.1-4.9

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110-54-3	Hexane	0.5-4
----------	--------	-------

A complex blend of petroleum-derived normal and branched-chain alkane, cycloalkane, alkene, and aromatic hydrocarbons. May contain antioxidant and multifunctional additives. Non-oxygenated Conventional Gasoline and RBOB do not have oxygenates (Ethanol). Oxygenated Conventional and Reformulated Gasoline will have oxygenates for octane enhancement or as legally required.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO₂, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Firefighting foam suitable for polar solvents is recommended for fuel with greater than 10% oxygenate concentration.

Unsuitable Extinguishing Media

None

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Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

*** Section 6 - Accidental Release Measures ***

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

*** Section 7 - Handling and Storage ***

Handling Procedures

USE ONLY AS A MOTOR FUEL.
DO NOT SIPHON BY MOUTH

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

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Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Gasoline, motor fuel (86290-81-5)

ACGIH: 300 ppm TWA
500 ppm STEL

Toluene (108-88-3)

ACGIH: 20 ppm TWA
OSHA: 200 ppm TWA; 375 mg/m³ TWA
150 ppm STEL; 560 mg/m³ STEL
NIOSH: 100 ppm TWA; 375 mg/m³ TWA
150 ppm STEL; 560 mg/m³ STEL

Butane (106-97-8)

ACGIH: 1000 ppm TWA (listed under Aliphatic hydrocarbon gases: Alkane C1-4)
OSHA: 800 ppm TWA; 1900 mg/m³ TWA
NIOSH: 800 ppm TWA; 1900 mg/m³ TWA

Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: 100 ppm TWA
150 ppm STEL
OSHA: 100 ppm TWA; 435 mg/m³ TWA
150 ppm STEL; 655 mg/m³ STEL

Benzene, 1,2,4-trimethyl- (95-63-6)

NIOSH: 25 ppm TWA; 125 mg/m³ TWA

Ethyl alcohol (64-17-5)

ACGIH: 1000 ppm STEL
OSHA: 1000 ppm TWA; 1900 mg/m³ TWA
NIOSH: 1000 ppm TWA; 1900 mg/m³ TWA

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Ethylbenzene (100-41-4)

ACGIH: 20 ppm TWA
OSHA: 100 ppm TWA; 435 mg/m³ TWA
125 ppm STEL; 545 mg/m³ STEL
NIOSH: 100 ppm TWA; 435 mg/m³ TWA
125 ppm STEL; 545 mg/m³ STEL

Benzene (71-43-2)

ACGIH: 0.5 ppm TWA
2.5 ppm STEL
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA
NIOSH: 0.1 ppm TWA
1 ppm STEL

Hexane (110-54-3)

ACGIH: 50 ppm TWA
Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA: 500 ppm TWA; 1800 mg/m³ TWA
NIOSH: 50 ppm TWA; 180 mg/m³ TWA

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

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*** Section 9 - Physical & Chemical Properties ***

Appearance:	Translucent, straw-colored or light yellow	Odor:	Strong, characteristic aromatic hydrocarbon odor. Sweet-ether like
Physical State:	Liquid	pH:	ND
Vapor Pressure:	6.4 - 15 RVP @ 100 °F (38 °C) (275-475 mm Hg @ 68 °F (20 °C)	Vapor Density:	AP 3-4
Boiling Point:	85-437 °F (39-200 °C)	Melting Point:	ND
Solubility (H2O):	Negligible to Slight	Specific Gravity:	0.70-0.78
Evaporation Rate:	10-11	VOC:	ND
Percent Volatile:	100%	Octanol/H2O Coeff.:	ND
Flash Point:	-45 °F (-43 °C)	Flash Point Method:	PMCC
Upper Flammability Limit (UFL):	7.6%	Lower Flammability Limit (LFL):	1.4%
Burning Rate:	ND	Auto Ignition:	>530°F (>280°C)

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

*** Section 11 - Toxicological Information ***

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Gasoline, motor fuel (86290-81-5)

Inhalation LC50 Rat >5.2 mg/L 4 h; Oral LD50 Rat 14000 mg/kg; Dermal LD50 Rabbit >2000 mg/kg

Toluene (108-88-3)

Inhalation LC50 Rat 12.5 mg/L 4 h; Inhalation LC50 Rat >26700 ppm 1 h; Oral LD50 Rat 636 mg/kg; Dermal LD50 Rabbit 8390 mg/kg; Dermal LD50 Rat 12124 mg/kg

Butane (106-97-8)

Inhalation LC50 Rat 658 mg/L 4 h

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Xylenes (o-, m-, p- isomers) (1330-20-7)

Inhalation LC50 Rat 5000 ppm 4 h; Inhalation LC50 Rat 47635 mg/L 4 h; Oral LD50 Rat 4300 mg/kg; Dermal LD50 Rabbit >1700 mg/kg

Benzene, 1,2,4-trimethyl- (95-63-6)

Inhalation LC50 Rat 18 g/m³ 4 h; Oral LD50 Rat 3400 mg/kg; Dermal LD50 Rabbit >3160 mg/kg

Ethyl alcohol (64-17-5)

Oral LD50 Rat 7060 mg/kg; Inhalation LC50 Rat 124.7 mg/L 4 h

Ethylbenzene (100-41-4)

Inhalation LC50 Rat 17.2 mg/L 4 h; Oral LD50 Rat 3500 mg/kg; Dermal LD50 Rabbit 15354 mg/kg

Benzene (71-43-2)

Inhalation LC50 Rat 13050-14380 ppm 4 h; Oral LD50 Rat 1800 mg/kg

Hexane (110-54-3)

Inhalation LC50 Rat 48000 ppm 4 h; Oral LD50 Rat 25 g/kg; Dermal LD50 Rabbit 3000 mg/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Moderate irritant. Contact with liquid or vapor may cause irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product may cause genetic defects.

Carcinogenicity

A: General Product Information

May cause cancer.

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IARC has determined that gasoline and gasoline exhaust are possibly carcinogenic in humans. Inhalation exposure to completely vaporized unleaded gasoline caused kidney cancers in male rats and liver tumors in female mice. The U.S. EPA has determined that the male kidney tumors are species-specific and are irrelevant for human health risk assessment. The significance of the tumors seen in female mice is not known. Exposure to light hydrocarbons in the same boiling range as this product has been associated in animal studies with effects to the central and peripheral nervous systems, liver, and kidneys. The significance of these animal models to predict similar human response to gasoline is uncertain.

This product contains benzene. Human health studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-forming system (particularly bone marrow), and serious blood disorders such as aplastic anemia and leukemia. Benzene is listed as a human carcinogen by the NTP, IARC, OSHA and ACGIH.

B: Component Carcinogenicity

Gasoline, motor fuel (86290-81-5)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

Toluene (108-88-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

Xylenes (o-, m-, p- isomers) (1330-20-7)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

IARC: Monograph 71 [1999]; Monograph 47 [1989] (Group 3 (not classifiable))

Ethyl alcohol (64-17-5)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

IARC: Monograph 100E [in preparation] (in alcoholic beverages); Monograph 96 [2010] (in alcoholic beverages) (Group 1 (carcinogenic to humans))

Ethylbenzene (100-41-4)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

IARC: Monograph 77 [2000] (Group 2B (possibly carcinogenic to humans))

Benzene (71-43-2)

ACGIH: A1 - Confirmed Human Carcinogen

OSHA: 5 ppm STEL (Cancer hazard, Flammable, See 29 CFR 1910.1028, 15 min); 0.5 ppm Action Level; 1 ppm TWA

NIOSH: potential occupational carcinogen

NTP: Known Human Carcinogen (Select Carcinogen)

IARC: Monograph 100F [in preparation]; Supplement 7 [1987]; Monograph 29 [1982] (Group 1 (carcinogenic to humans))

Reproductive Toxicity

This product is suspected of damaging fertility or the unborn child.

Specified Target Organ General Toxicity: Single Exposure

This product may cause drowsiness or dizziness.

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Specified Target Organ General Toxicity: Repeated Exposure

This product causes damage to organs through prolonged or repeated exposure.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Very toxic to aquatic life with long lasting effects. Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Gasoline, motor fuel (86290-81-5)

Test & Species

Conditions

96 Hr LC50 Alburnus alburnus	119 mg/L [static]
96 Hr LC50 Cyprinodon variegatus	82 mg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	56 mg/L
24 Hr EC50 Daphnia magna	170 mg/L

Toluene (108-88-3)

Test & Species

Conditions

96 Hr LC50 Pimephales promelas	15.22-19.05 mg/L [flow-through]	1 day old
96 Hr LC50 Pimephales promelas	12.6 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.89-7.81 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	14.1-17.16 mg/L [static]	
96 Hr LC50 Oncorhynchus mykiss	5.8 mg/L [semi-static]	
96 Hr LC50 Lepomis macrochirus	11.0-15.0 mg/L [static]	
96 Hr LC50 Oryzias latipes	54 mg/L [static]	
96 Hr LC50 Poecilia reticulata	28.2 mg/L [semi-static]	
96 Hr LC50 Poecilia reticulata	50.87-70.34 mg/L [static]	
96 Hr EC50 Pseudokirchneriella subcapitata	>433 mg/L	
72 Hr EC50 Pseudokirchneriella subcapitata	12.5 mg/L [static]	
48 Hr EC50 Daphnia magna	5.46 - 9.83 mg/L [Static]	
48 Hr EC50 Daphnia magna	11.5 mg/L	

Xylenes (o-, m-, p- isomers) (1330-20-7)

Test & Species

Conditions

96 Hr LC50 Pimephales promelas	13.4 mg/L [flow-through]
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96 Hr LC50 Oncorhynchus mykiss	2.661-4.093 mg/L [static]
96 Hr LC50 Oncorhynchus mykiss	13.5-17.3 mg/L
96 Hr LC50 Lepomis macrochirus	13.1-16.5 mg/L [flow-through]
96 Hr LC50 Lepomis macrochirus	19 mg/L
96 Hr LC50 Lepomis macrochirus	7.711-9.591 mg/L [static]
96 Hr LC50 Pimephales promelas	23.53-29.97 mg/L [static]
96 Hr LC50 Cyprinus carpio	780 mg/L [semi- static]
96 Hr LC50 Cyprinus carpio	>780 mg/L
96 Hr LC50 Poecilia reticulata	30.26-40.75 mg/L [static]
48 Hr EC50 water flea	3.82 mg/L
48 Hr LC50 Gammarus lacustris	0.6 mg/L

Benzene, 1,2,4-trimethyl- (95-63-6)

Test & Species

Conditions

96 Hr LC50 Pimephales promelas	7.19-8.28 mg/L [flow-through]
48 Hr EC50 Daphnia magna	6.14 mg/L

Ethyl alcohol (64-17-5)

Test & Species

Conditions

96 Hr LC50 Oncorhynchus mykiss	12.0 - 16.0 mL/L [static]
96 Hr LC50 Pimephales promelas	>100 mg/L [static]
96 Hr LC50 Pimephales promelas	13400 - 15100 mg/L [flow-through]
48 Hr LC50 Daphnia magna	9268 - 14221 mg/L
24 Hr EC50 Daphnia magna	10800 mg/L
48 Hr EC50 Daphnia magna	2 mg/L [Static]

Ethylbenzene (100-41-4)

Test & Species

Conditions

96 Hr LC50 Oncorhynchus mykiss	11.0-18.0 mg/L [static]
96 Hr LC50 Oncorhynchus mykiss	4.2 mg/L [semi- static]
96 Hr LC50 Pimephales promelas	7.55-11 mg/L [flow- through]
96 Hr LC50 Lepomis macrochirus	32 mg/L [static]
96 Hr LC50 Pimephales promelas	9.1-15.6 mg/L [static]
96 Hr LC50 Poecilia reticulata	9.6 mg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	4.6 mg/L
96 Hr EC50 Pseudokirchneriella subcapitata	>438 mg/L
72 Hr EC50 Pseudokirchneriella subcapitata	2.6 - 11.3 mg/L [static]

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

96 Hr EC50 Pseudokirchneriella subcapitata	1.7 - 7.6 mg/L [static]
48 Hr EC50 Daphnia magna	1.8 - 2.4 mg/L

Benzene (71-43-2)

Test & Species

Conditions

96 Hr LC50 Pimephales promelas	10.7-14.7 mg/L [flow-through]
96 Hr LC50 Oncorhynchus mykiss	5.3 mg/L [flow-through]
96 Hr LC50 Lepomis macrochirus	22.49 mg/L [static]
96 Hr LC50 Poecilia reticulata	28.6 mg/L [static]
96 Hr LC50 Pimephales promelas	22330-41160 µg/L [static]
96 Hr LC50 Lepomis macrochirus	70000-142000 µg/L [static]
72 Hr EC50 Pseudokirchneriella subcapitata	29 mg/L
48 Hr EC50 Daphnia magna	8.76 - 15.6 mg/L [Static]
48 Hr EC50 Daphnia magna	10 mg/L

Hexane (110-54-3)

Test & Species

Conditions

96 Hr LC50 Pimephales promelas	2.1-2.98 mg/L [flow-through]
24 Hr EC50 Daphnia magna	>1000 mg/L

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** * * Section 13 - Disposal Considerations * * ***

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

*** Section 14 - Transportation Information ***

Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

DOT Information

Shipping Name: Gasoline

UN #: 1203 Hazard Class: 3 Packing Group: II

Placard:



*** Section 15 - Regulatory Information ***

Regulatory Information

A: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Toluene (108-88-3)

SARA 313: 1.0 % de minimis concentration
CERCLA: 1000 lb final RQ; 454 kg final RQ

Xylenes (o-, m-, p- isomers) (1330-20-7)

SARA 313: 1.0 % de minimis concentration
CERCLA: 100 lb final RQ; 45.4 kg final RQ

Benzene, 1,2,4-trimethyl- (95-63-6)

SARA 313: 1.0 % de minimis concentration

Ethylbenzene (100-41-4)

SARA 313: 0.1 % de minimis concentration
CERCLA: 1000 lb final RQ; 454 kg final RQ

Benzene (71-43-2)

SARA 313: 0.1 % de minimis concentration
CERCLA: 10 lb final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule); 4.54 kg final RQ (received an adjusted RQ of 10 lbs based on potential carcinogenicity in an August 14, 1989 final rule)

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

Hexane (110-54-3)

SARA 313: 1.0 % de minimis concentration

CERCLA: 5000 lb final RQ; 2270 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health

X

Chronic Health

X

Fire

X

Sudden Release of Pressure

--

Reactive

--

Component Marine Pollutants

This material contains one or more of the following chemicals required by US DOT to be identified as marine pollutants.

Component	CAS #	
Gasoline, motor fuel	86290-81-5	DOT regulated marine pollutant

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Gasoline, motor fuel	86290-81-5	No	No	No	No	Yes	No
Toluene	108-88-3	Yes	Yes	Yes	Yes	Yes	No
Butane	106-97-8	Yes	Yes	Yes	Yes	Yes	No
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	Yes	Yes	Yes	Yes	No
Benzene, 1,2,4-trimethyl-	95-63-6	No	Yes	Yes	Yes	Yes	No
Ethyl alcohol	64-17-5	Yes	Yes	Yes	Yes	Yes	No
Ethylbenzene	100-41-4	Yes	Yes	Yes	Yes	Yes	No
Benzene	71-43-2	Yes	Yes	Yes	Yes	Yes	No
Hexane	110-54-3	No	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

WARNING! This product contains a chemical known to the state of California to cause reproductive/developmental effects.

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Toluene	108-88-3	1 %
Butane	106-97-8	1 %
Benzene, 1,2,4-trimethyl-	95-63-6	0.1 %
Ethyl alcohol	64-17-5	0.1 %
Ethylbenzene	100-41-4	0.1 %
Benzene	71-43-2	0.1 %
Hexane	110-54-3	1 %

Additional Regulatory Information

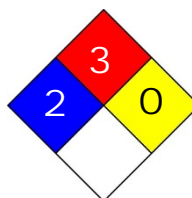
Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Gasoline, motor fuel	86290-81-5	No	DSL	EINECS
Toluene	108-88-3	Yes	DSL	EINECS
Butane	106-97-8	Yes	DSL	EINECS
Xylenes (o-, m-, p- isomers)	1330-20-7	Yes	DSL	EINECS
Benzene, 1,2,4-trimethyl-	95-63-6	Yes	DSL	EINECS
Ethyl alcohol	64-17-5	Yes	DSL	EINECS
Ethylbenzene	100-41-4	Yes	DSL	EINECS
Benzene	71-43-2	Yes	DSL	EINECS
Hexane	110-54-3	Yes	DSL	EINECS

*** Section 16 - Other Information ***

NFPA® Hazard Rating

Health	2
Fire	3
Reactivity	0



HMIS® Hazard Rating

Health	2	Moderate
Fire	3	Serious
Physical	0	Minimal

*Chronic

Key/Legend

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration., NJTSR = New Jersey Trade Secret Registry.

Literature References

None

Safety Data Sheet

Material Name: Gasoline All Grades

SDS No. 9950

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet



SAFETY DATA SHEET

SDS ID NO.: 0298MAR019
Revision Date 05/22/2015

1. IDENTIFICATION

Product Name: Marathon Petroleum Premium AW II Hydraulic Oil

Synonym: Premium AW II ISO 32 Hydraulic Oil; Premium AW II ISO 46 Hydraulic Oil; Premium AW II ISO 68 Hydraulic Oil; Premium AW II ISO 100 Hydraulic Oil; ISO 32 Premium AW II Hydraulic Oil; ISO 46 Premium AW II Hydraulic Oil; ISO 68 Premium AW II Hydraulic Oil; ISO 100 Premium AW II Hydraulic Oil

Product Code: 0298MAR019

Chemical Family: Hydrocarbon Mixture

Recommended Use: Hydraulic Fluid.

Restrictions on Use: All others.

Manufacturer, Importer, or Responsible Party Name and Address:
MARATHON PETROLEUM COMPANY LP
539 South Main Street
Findlay, OH 45840

SDS information: 1-419-421-3070

Emergency Telephone: 1-877-627-5463

2. HAZARD IDENTIFICATION

Classification

OSHA Regulatory Status

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute aquatic toxicity	Category 3
Chronic aquatic toxicity	Category 3

Hazards Not Otherwise Classified (HNOC)

Not applicable.

Label elements

EMERGENCY OVERVIEW

Harmful to aquatic life with long lasting effects

Appearance Clear Liquid **Physical State** Liquid **Odor** Petroleum

Precautionary Statements - Prevention

Avoid release to the environment

Precautionary Statements - Response

Not applicable.

Precautionary Statements - Storage

Not applicable.

Precautionary Statements - Disposal

Dispose of contents/container at an approved waste disposal plant

Additional Information

Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Lube oil is a complex mixture of highly refined lubricating base stocks and additives.

Composition Information:

Name	CAS Number	% Concentration
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	64742-54-7	98-99
2,6-di-tert-butylphenol	128-39-2	0.1-1

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures

General Advice:	In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).
Inhalation:	Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). If symptoms occur get medical attention.
Skin Contact:	Wash skin with plenty of soap and water. If irritation or other symptoms occur get medical attention. Wash contaminated clothing and clean shoes before reuse. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).
Eye Contact:	Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.
Ingestion:	Rinse mouth out with water. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. If symptoms develop, seek medical attention.

Most important signs and symptoms, both short-term and delayed with overexposure

Adverse Effects:	Preexisting skin conditions and/or respiratory disorders may be aggravated by exposure to this product.
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Indication of any immediate medical attention and special treatment needed

Notes To Physician:	SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small
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puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

For small fires, Class B fire extinguishing media such as CO₂, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire.

Specific hazards arising from the chemical

The product is not combustible per the OSHA Hazard Communication Standard, but will ignite and burn at temperatures exceeding the flash point.

Hazardous combustion products

Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data

Sensitivity to Mechanical Impact No.

Sensitivity to Static Discharge No.

Special protective equipment and precautions for firefighters

Avoid using straight water streams. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Avoid excessive water spray application. Use water spray to cool exposed surfaces from as far a distance as possible. Keep run-off water out of sewers and water sources.

Additional firefighting tactics

Not applicable.

NFPA

Health 1

Flammability 1

Instability 0

Special Hazard -

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:

Keep public away. Isolate and evacuate area. Shut off source if safe to do so.

Protective equipment:

Use personal protection measures as recommended in Section 8.

Emergency procedures:

Advise authorities and National Response Center (800-424-8802) if the product has entered a water course or sewer. Notify local health and pollution control agencies, if appropriate.

Environmental precautions:

Avoid release to the environment. Avoid subsoil penetration.

Methods and materials for containment:

Prevent further leakage or spillage if safe to do so.

Methods and materials for cleaning up:

Use suitable absorbent materials such as vermiculite, sand, or clay to clean up residual liquids. Recover and return free product to proper containers.

7. HANDLING AND STORAGE

Safe Handling Precautions:

Avoid contact with skin, eyes and clothing. Do not swallow. Avoid breathing vapors or mists.

Use good personal hygiene practices. Wash thoroughly after handling. Use personal protection measures as recommended in Section 8. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.

High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).

Storage Conditions:

Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Store away from incompatible materials.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELs:	OSHA - Vacated PELs	NIOSH IDLH
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	Mineral oil, highly/severely refined, inhalable fraction 5 mg/m ³ TWA	-	-	-
2,6-di-tert-butylphenol 128-39-2	-	-	-	-

Notes:

The manufacturer has voluntarily elected to provide exposure limits contained in OSHA's 1989 air contaminants standard in its SDSs, even though certain of those exposure limits were vacated in 1992.

Engineering measures:

Local or general exhaust required when using at elevated temperatures that generate vapors or mists.

Personal protective equipment**Eye protection:**

Use goggles or face-shield if the potential for splashing exists.

Skin and body protection:

Wear neoprene, nitrile or PVA gloves to prevent skin contact. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times. Wear appropriate protective clothing.

Respiratory protection:

Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.

Hygiene measures:

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Liquid
Appearance	Clear Liquid
Color	Clear
Odor	Petroleum
Odor Threshold	No data available.

<u>Property</u>	<u>Values (Method)</u>
Melting Point / Freezing Point	No data available.
Initial Boiling Point / Boiling Range	No data available.
Flash Point	> 220 °C / > 428 °F (Cleveland Open-Cup)
Evaporation Rate	No data available.
Flammability (solid, gas)	Not applicable.
Flammability Limit in Air (%):	
Upper Flammability Limit:	No data available.
Lower Flammability Limit:	No data available.
Explosion limits:	No data available.
Vapor Pressure	No data available.
Vapor Density	No data available.
Specific Gravity / Relative Density	0.88
Water Solubility	No data available.
Solubility in other solvents	No data available.
Partition Coefficient	No data available.
Decomposition temperature	No data available.
pH:	No available data.
Autoignition Temperature	No data available.
Kinematic Viscosity	≥ 28.8 mm ² /s @ 40°C / 104°F (ASTM D445)
Dynamic Viscosity	No data available.
Explosive Properties	No data available.
VOC Content (%)	0.12-37.7 (w/w)
Density	No data available.
Bulk Density	Not applicable.

10. STABILITY AND REACTIVITY

<u>Reactivity</u>	The product is non-reactive under normal conditions.
<u>Chemical stability</u>	Stable under recommended storage conditions.
<u>Possibility of hazardous reactions</u>	None under normal processing.
<u>Hazardous polymerization</u>	Will not occur.
<u>Conditions to avoid</u>	Sources of heat or ignition.
<u>Incompatible Materials</u>	Strong oxidizing agents.
<u>Hazardous decomposition products</u>	None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation	Overheating may produce vapors which may cause respiratory irritation, dizziness and nausea.
Eye contact	Exposure to vapor or contact with liquid may cause mild eye irritation, including tearing, stinging, and redness.
Skin contact	Prolonged or repeated exposure may cause dermatitis, folliculitis or oil acne.
Ingestion	May cause irritation of the mouth, throat and gastrointestinal tract.

Acute toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
Solvent Refined, Hydrotreated	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.5 mg/l (Rat) 4 h

Heavy Paraffinic Distillate 64742-54-7			
2,6-di-tert-butylphenol 128-39-2	> 5000 mg/kg (Rat)	> 10 g/kg (Rabbit)	-

Delayed and immediate effects as well as chronic effects from short and long-term exposure

This product is considered to have a low order of acute and chronic oral and dermal toxicity.

Adverse effects related to the physical, chemical and toxicological characteristics

Signs and Symptoms Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.

Sensitization Not expected to be a skin or respiratory sensitizer.

Mutagenic effects None known.

Carcinogenicity Cancer designations are listed in the table below

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	Mineral oil, poorly/mildly refined Suspected Human Carcinogen (A2) Mineral oil, highly/severely refined, inhalable fraction Not Classifiable (A4)	Mineral oil, untreated or mildly treated Carcinogenic to humans (1) Mineral oil, highly refined Not Classifiable (3)	Mineral oil, poorly/mildly refined Known to be human carcinogen	Not Listed
2,6-di-tert-butylphenol 128-39-2	Not Listed	Not Listed	Not Listed	Not Listed

Reproductive toxicity None known.

**Specific Target Organ Toxicity
(STOT) - single exposure** Not classified.

**Specific Target Organ Toxicity
(STOT) - repeated exposure** Not classified.

Aspiration hazard Not classified.

12. ECOLOGICAL INFORMATION

Ecotoxicity Harmful to aquatic life with long lasting effects.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate 64742-54-7	-	96-hr LC50 = 5000 mg/L Rainbow trout	-	48-hr EC50 = 1000 mg/L Daphnia magna
2,6-di-tert-butylphenol 128-39-2	-	-	-	48-hr EC50 = 0.45 mg/l Daphnia magna

Persistence and degradability No information available.

Bioaccumulation Contains component(s) with the potential to bioaccumulate.

Mobility in soil No information available.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues

No information available.

Safe Handling of Wastes

Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required.

Disposal of Wastes / Methods of Disposal

The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal

Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101):

UN Proper Shipping Name:	Not Regulated
UN/Identification No:	Not applicable
Class:	Not applicable.
Packing Group:	Not applicable.

TDG (Canada):

UN Proper Shipping Name:	Not Regulated
UN/Identification No:	Not applicable.
Transport Hazard Class(es):	Not applicable.
Packing Group:	Not applicable.

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b):	This product and/or its components are listed on the TSCA Chemical Inventory.
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EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product may contain component(s) that have been listed on EPA's Extremely Hazardous Substance (EHS) List:

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	NA
2,6-di-tert-butylphenol	NA

SARA Section 304: This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	Hazardous Substances RQs
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	NA
2,6-di-tert-butylphenol	NA

SARA Section 311/312: The following EPA hazard categories apply to this product:

None

SARA Section 313: This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
Solvent Refined, Hydrotreated Heavy Paraffinic Distillate	None
2,6-di-tert-butylphenol	None

State and Community Right-To-Know Regulations:

The following component(s) of this material are identified on the regulatory lists below:

Solvent Refined, Hydrotreated Heavy Paraffinic Distillate

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed
Pennsylvania Right-To-Know:	Not Listed
Massachusetts Right-To-Know:	Not Listed
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Carcinogen
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

2,6-di-tert-butylphenol

Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	Not Listed
Pennsylvania Right-To-Know:	Not Listed
Massachusetts Right-To-Know:	Not Listed
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous Substances:	Not Listed
New Jersey - Special Hazardous Substances:	Not Listed
New Jersey - Environmental Hazardous Substances List:	Not Listed
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 - List of Hazardous Substances:	Not Listed

Canada DSL/NDL Inventory: This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information: This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all of the information required by those regulations.

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
2,6-di-tert-butylphenol	D2B	1%

Note: Uncontrolled product according to WHMIS classification criteria.

16. OTHER INFORMATION

Prepared By Toxicology and Product Safety

Revision Notes

Revision Date 05/22/2015

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Attachment 6 – Resumes and Qualifications

**ADDITIONAL RESUMES AND QUALIFICATIONS TO BE ADDED AS THOSE
PERSONNEL ARE IDENTIFIED**

Areas of Expertise

EHS Compliance
Industrial Hygiene
Safety Engineering
Process Safety Management
Food Safety

Years of Experience

With AECOM: 20 Years
With USACE: 9 Years

Education

B.S./1984/Forest
Management/University of Missouri,
Columbia, MO
Chemistry and Biology Secondary
Teaching Endorsements in
/1988/Creighton University,
Omaha, NE

Registration/Certification

Certified Industrial Hygienist,
6553
Certified Safety Professional,
#13593
EPA Risk Assessor
OSHA Hazardous Waste
Operations (40 hour)
OSHA Hazardous Waste
Operations Site Supervisor

Dennis Day CIH, CSP, PCQI

*Certified Industrial Hygienist, Certified Safety
Professional,
Preventative Controls Qualified Individual*



Overview

Mr. Day has over 25 years of experience in safety oversight at hazardous waste sites, industrial hygiene monitoring, safety engineering, laboratory decommissioning, ionizing and non-ionizing radiation, product stewardship, environmental auditing, and machine guarding, chemical management. Mr. Day has provided original safety program documents, authored guidance documents, and audited compliance for management systems, environmental regulations, safety, and industrial hygiene. Mr. Day has managed national and international industrial hygiene programs for clients in petroleum, electronics and industrial chemical manufacturing.

Mr. Day has provided clients with interdisciplinary expertise in hazard analysis and the required planning to mitigate hazards. Dennis has expertise in risk management planning, indoor air quality, area air monitoring and ventilation evaluation, due diligence assessments, biological risk assessment, pollution prevention and waste minimization studies, and industrial hygiene/safety engineering design analysis. Dennis is co-editor and author of the Biological Risk Engineering Handbook and Air Sampling and Industrial Hygiene Engineering and other three other texts published by CRC Press. Dennis has audited international programs to determine client compliance with United States, EU, and specific governmental requirements and provided assistance in reducing risk within manufacturing facilities.

Work Experience

Design/Process Safety Management (PSM)/Risk Management
Planning— Evaluations & Auditing

Omaha Public Power District, Nebraska City NE, Nebraska City
Station Unit 2. Performed review of Process Safety Management and Risk
Management Planning aspects of an Ammonia Selective Catalytic Reduction
(SCR) system including; conducting offsite consequence analysis, reviewing
safety issues related to the ammonia storage and injection system, loading and
unloading procedures, area air monitoring specification and placement,
process safety relief valve specifications and placement, providing OSHA
hazwoper training for operators since 2008.

AstraZeneca, Frederick Maryland. Conducted 30 room assessment of the
compressed gas cylinder storage, usage and associated area air monitoring
sensors. Developed a spreadsheet to calculate and evaluate potential
emergency release scenarios and evaluation of air monitoring sensors;
placement, detection appropriateness, calibration and alarms effectiveness.

Port of LA, CA. Co-author of health and safety conceptual design chapters for Port of LA. Concepts to be used in ultimate design of ports container inspection facility. Coordinated health and safety conceptual design with Northrop Grumman designs for container inspection instrumentation and on-site warning systems.

British Petroleum – Tbilisi Georgia. Health, Safety and Biological Risk Assessment Consultant for the Baku-Tbilisi-Ceyhan (BTC) Oil Pipeline. Mr. Day was responsible for developing and conducting a safety, health and biological risk assessment for the Landfill Conditioning Plan at the Iagluja Landfill.

Tooele Army Depot, UT. Co-author of Airborne Exposure Limit (AEL) based Decontamination Plan for chemical warfare materiel equipment and building decontamination and waste shipment offsite.

Magellan; OK, TX, IA. PSM audit of butane blending and fractionator facilities. Audits included PSM regulatory audit required by OSHA.

Dynachem, IL. Technical assistance for Risk Management Planning and Program development at facilities that manufacture epoxy and phenolic resin. Evaluated the adequacy of: process safety information; written operating procedures; process hazard analyses; operator training and documentation; contractor safety evaluation; procedures, training, testing and documentation to ensure the on-going mechanical integrity of equipment; management-of-change procedures; incident investigation and follow-up procedures and emergency planning.

Risk Management and PSM Program and Plan development including Process Hazard Analysis (PHA), FMEA, fault free analysis, job hazard analysis, management of change and training. Risk Management Program development including ambient, background, interior, perimeter, and event horizon air dispersion calculations. Air dispersion results used for compliance and design planning, including predesign option analysis.

Coordination with industrial neighbors, emergency responders, and local residents. Development of Integrated Emergency/Contingency Response Protocols.

Agrium, NE and KS. Agrium, Various Locations, US and Canada. Project leader for Agricultural Industry PSM and Risk Management Planning and Program development, chemical safety audits, planning and program development. Issues of concern included fertilizer manufacture and transfer. Evaluated the adequacy of: process safety information; written operating procedures; process hazard analyses; operator training and documentation; contractor safety evaluation; procedures, training, testing and documentation to ensure the on-going mechanical integrity of equipment; management-of-change procedures; incident investigation and follow-up procedures and emergency planning.

Risk Management and PSM Program and Plan Development including Process Hazard Analysis (PHA), FMEA, fault free analysis, job hazard analysis, management of change and training. Risk Management Program development including ambient, background, interior, perimeter, and event horizon air dispersion calculations. Conversion of HAZOP protocols to FMEA for use in Risk Management Plan and Program development. Air dispersion results used for compliance and design planning, including predesign option analysis.

Coordination with industrial neighbors, emergency responders, and local residents. Development of Integrated Emergency/Contingency Response Protocols.

LCRA, TX. Process evaluations of water treatment and power generation facilities – including piping; boilers; heating, ventilation, air conditioning (HVAC) systems, and process vessels per State of Texas and US government requirements.

TransAmerica and ExtraLease, NJ. Process and industrial hygiene evaluations. Evaluated environmental and indoor air quality related to collocation with waste treatment facilities. Conducted assessment of on-site job tasks and associated interrelationships between environmental air quality and workplace air quality. Evaluated XtraLease site for OSHA compliance given processes on-site and in near-by environs.

Cargill, NE. Training for senior management on Risk Management Program and Planning requirements.

DoD, DoE and Confidential Industrial Clients, Various Locations, US. Piping and Process evaluations for process piping associated with refineries, chemical transfer, and fuel supplies. Associated industrial processes included quench furnaces, cryogenic treatment, power generation, chemical treatment, industrial

wastewater, air stripping, in situ vitrification, and movement of classified chemicals. Transfer systems included both new and legacy systems. Evaluations of fluid flow parameters given valving, piping conformation, and receiving process vessels.

Food Safety

As a PCQI, provided Hazard Analysis and Preventative Controls Determination (HARPC) gap analysis. Provided HARPC templates for small, medium, and large food and food contact facilities.

Developed Food Safety Plans for compliance with the Food Safety Modernization Act (FSMA); including validation and verification of preventative controls, allergen and sensitization evaluation methods; and supply chain evaluation criteria. Created proprietary database for use in assessments, audits, gap analysis, and implementation of FSMA. Assessed good management practices and current good management practices (per FSMA).

Developed programs and implementation checklists for : 1) process preventive controls; 2) sanitation prevention controls; 3) food allergen controls; 4) supply-chain management controls; 5) verification and validation procedures; 6) record keeping procedures; 7) recall plan.

Evaluated food contact criteria for manufacture's of dyes, inks, and adhesives used in food packaging. Researched substitution food contact chemicals for food packaging, equipment maintenance, and general plant and/or equipment decontamination events. Evaluated criteria and current listing for Generally Recognized As Safe (GRAS) food components.

Georgia Pacific/Dixie/Koch, 2007 to present, throughout US: Conducted Food Safety, Product Stewardship, Health, Safety and Industrial Hygiene Auditing. As part of a blended audit program where both 3rd Party auditors, in-house GP subject matter experts and GP EHS managers from other facilities conducted EHS audit at GP sawmill, pulpmills, Paper Plants, Corrugated Box Plants, Dixie Tissue and Paper Plates/Cups and other manufacturing facilities. Also, performed preparation audits for OSHA VPP. Audits included an assessment of machine guarding requirements.

FDA GMP, Pharmaceutical Company, Laboratory, Medical Center Services - Biological and Chemical Assessments

Pharma Multi-National (Canada, Ireland, United Kingdom, United States) Pharmaceutical Using US Food and Drug Administration protocols and Good Management Practices (GMP); investigated facilities for residual contamination, active pharmaceutical ingredients, and sensitizers. Provided decommissioning and decontamination specifications, general work plans, site safety and health plans, quality assurance and control plans, sampling and analysis plans, and waste disposal profile plans. Oversight of decontamination. Issuance of comprehensive decontamination report.

Provided comprehensive assessment, audit, and program implementation support including assessment for Good Management Practices (GMP) and FDA requirements Analyzed distribution of active pharmaceutical ingredients within process lines, ventilation systems, and surface location. Determined occupational exposure limits, occupational exposure bands, and resultant API monitoring parameters.

Pilot study to determine effectiveness of various decontamination solutions and routines. Investigation performed in coordination with Bureau Veritas.

Program development and implementation assistance to include: bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency exits and life safety, emergency planning & fire protection (life safety codes), fall protection (ladders, working platforms), hazard communication, flammable and combustible materials use and storage, heat stress, machine guarding, medical

and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, ergonomics, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation and electrical safety (grounding, overcurrent protection, arc flash). Updating environmental regulatory response per RCRA, NPDES, and other requirements.

TK Holdings: 2016 to present: Environmental Health and Safety Audits of 22 locations in USA, Mexico and South America.

Confidential Multi-National Clients Evaluated full suite of OSHA safety programs, emergency response, and industrial hygiene issues for due diligence associated with acquisitions. Emphasis on bloodborne pathogens, chemical exposure potential (VOCs, silica, asbestos, lead, isocyanates, hexavalent chromium), compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, ergonomics, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation in accordance with 29 CFR 1910.147 for industrial sites and 1926.417 for construction sites. Consideration, as appropriate, to 1910.269, 1910.306, 1910.333, and 1926.702. Verification sequence programmatic review included applicable and relevant OSHA standard to include NEC requirements. Regulatory review of US laws, EU directives RoHS/WEEE/REACH, ANSI standards, NFPA, NEC, and specific country regulations Assessment of the applicability of the three European Directives that are key elements of EU's environmental policy on chemical and waste management. Influence of these directives and local (country specific) legal acts were included in the comprehensive review. Future action plans were proposed in order to provide comprehensive and effective implementation of the RoHS/WEEE/REACH at the facility and to aid in purchasing decisions given environmental, health, and safety needs at the facility. Consultant services with emphasis on chemical exposure potential and inherent hazards. Assessment of production areas, raw materials, equipment used, sustainability, and recycling. Database development.

GE Power and GE Medical: Evaluated full suite of OSHA safety programs, emergency response, and industrial hygiene issues for due diligence associated with acquisitions. Emphasis on bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation in accordance with 29 CFR 1910.147 for industrial sites and 1926.417 for construction sites. Consideration, as appropriate, to 1910.269, 1910.306, 1910.333, and 1926.702. Verification sequence programmatic review included applicable and relevant OSHA standard to include NEC requirements.

Confidential Client: China, Industrial Hygiene Services at sites located in the following countries; Hong Kong, Korea, Malaysia, Taiwan and USA. 2010 and 2011. Project Manager for comprehensive industrial hygiene services to evaluate exposures and determine medical surveillance protocols if any. Services included: conducting; a Qualitative Exposure Assessment (QEA), a Site-specific Industrial Hygiene Sampling and Analysis Plan (IHSAP), and Industrial Hygiene Quantitative Assessments (IHQA). 1) The QEA provided a documented, systematic evaluation and relative risk ranking of employee exposures to hazardous agents (chemical, physical, biological) during the execution of specific tasks within similar exposed groups (SEG) of workers. The QEA evaluated and summarized work place, work force and hazardous agent information and

existing industrial hygiene data. 2) The site-specific IHSAP utilized information collected during the QEA conducted by URS, or by a QEA previously conducted by others. The IHSAP included the following:

- List similar exposure group (job title) and activities to be sampled.
- List chemical, physical agents and associated raw materials/products to be sampled.
- Confirm sampling method and analytical methods have the required sensitivity/detection limits for the above comparisons.
- Indicates minimum sampling duration, rate and total volume sufficient to reach less than 10% of applicable exposure limits.
- Document process, specific products/raw materials, locations (e.g., mixer tank #2) during exposure assessments, as well as engineering controls, PPE usage, equipment calibrations.
- Collect additional information concerning each activity; cycle time (e.g., daily, weekly, monthly), generation rate (sporadic active, sporadic passive, daily active, daily passive, continual passive, daily active, continual active), number of employees involved in activity. Additional observation of work practices.
- Use NIOSH/OSHA analytical methods or regionally required/accepted methodologies
- Prepare a photographic log of activities and engineering controls associated with samples.
- Compare results to local regulatory standards and most current of American Conference of Industrial Hygienists Threshold Limit Values (TLVs)

URS then conduct area and personnel air monitoring (including hydrogen fluoride, and hexavalent chromium), noise dosimetry and other hazardous agent assessments representative of employee exposures for each SEG as indicated by the IHSAP.

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles. CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

URS Corporation, Corporate Regional Safety Health and Environmental Manager, 1999 through present. Responsible for managing the occupational safety and health program for URS Employees including industrial hygiene monitoring, interpretation of results, and liaison for the medical surveillance program for between 100 to 400 employees (depending upon the organizational structure). Duties include collecting and interpreting industrial hygiene data for exposures including asbestos, lead, mercury, volatile organic compounds, heavy metals, silica and welding fumes.

Magellan Midstream Partners, CO, CT, DE, IA, KS, LA, MN, NE, OK, SD, TX, WI, 2005 through 2012: Developed and implemented a comprehensive industrial hygiene monitoring program for petroleum transportation, storage and distribution facilities. Performed industrial hygiene monitoring for hundreds of employees at over 40 facilities in 12 states. Developed a database for tracking and reporting data for parameters that include NORM, benzene, lead, hexavalent chromium, butadiene, hydrogen sulfide and dozens of other volatile organic compounds and particulates.

British Petroleum – Tbilisi Georgia. Industrial Hygiene and Safety Consultant for the Baku-Tbilisi-Ceyhan (BTC) Oil Pipeline. Mr. Day was responsible for development, implementation of industrial hygiene programs and health and safety auditing for a BTC construction project. Conducted a Quantitative Health and Safety Scotts; CA, CO, IA, IL, OR, PA, SC; EHS and industrial hygiene compliance assessment for Scotts/Miracle Grow. Review of current programs, training, and recordkeeping. Assessment of safety program implementation.

Biological Vulnerability Assessments, Planning, and Decontamination

Pharma Multi-National (Canada, Ireland, United Kingdom, United States) Pharmaceutical Using US Food and Drug Administration protocols and Good Management Practices (GMP); investigated facilities for residual contamination, active pharmaceutical ingredients, and sensitizers. Provided decommissioning and decontamination specifications, general work plans, site safety and health plans, quality assurance and control plans, sampling and analysis plans, and waste disposal profile plans. Oversight of decontamination. Issuance of comprehensive decontamination report.

Provided comprehensive assessment, audit, and program implementation support including assessment for Good Management Practices (GMP) and FDA requirements. Analyzed distribution of active pharmaceutical ingredients within process lines, ventilation systems, and surface location. Determined occupational exposure limits, occupational exposure bands, and resultant API monitoring parameters.

Pilot study to determine effectiveness of various decontamination solutions and routines. Investigation performed in coordination with Bureau Veritas.

Program development and implementation assistance to include: bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency exits and life safety, emergency planning & fire protection (life safety codes), fall protection (ladders, working platforms), hazard communication, flammable and combustible materials use and storage, heat stress, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, ergonomics, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation and electrical safety (grounding, overcurrent protection, arc flash). Updating environmental regulatory response per RCRA, NPDES, and other requirements.

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles, CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

US Federal Government, Various Locations, US Biological Risk Assessments and Decontamination Specifications: Developed assessment protocols, construction specifications, construction management protocols, and decontamination routines for facility remediations of US government, medical, industrial, residential, and commercial sites. Performed Microbiological Monitoring and Ventilation Studies with emphasis on engineering control and sanitation requirements to include gas/vapor monitoring, liquid/solid sampling, and biological monitoring.

Midwest Laboratories, NE. Established team approach with Midwest Laboratories for client's industrial hygiene needs, including gas/vapor monitoring, liquid/solid sampling, and biological monitoring. *Legionella* assessment for confidential industrial client to include sampling and interpretation of risk associated with cooling towers and standing waters. *Stachybotrys* investigation for multiple residential clients in association with health condition etiology determination. *Aspergillus*, *Penicillium*, and General Mold/Fungi Contamination Assessments for confidential industrial clients, schools, and residential clients.

Confidential Industrial Clients, Various Locations, US. Due Diligence Biological Risk Assessment: Developed assessment protocols, management protocols, and decontamination routines for Phase II facility assessment of an office complexes, hotels, restaurants, and heavy industry sites. Provided initial assessment and diagnosis of biological contamination causation and the potential for decontamination. Evaluated heating ventilation and air conditioning (HVAC) equipment and supply areas, maintenance and facilities, and general indoor air.

Confidential Clients *Legionella* assessments Sampling and interpretation of risk associated with cooling towers and standing waters. Microbiological monitoring and ventilation studies with emphasis on engineering control and sanitation requirements.

Confidential Clients – Insurance Agencies, Various Locations, US. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Confidential Clients - Medical Facility Biological Assessment, Various Locations, US. Evaluation of operating room suites, equipment and supply areas, maintenance and vehicle use facilities, and general indoor air.

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles. CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

FEMA Responder World Trade Center, NY. Provided assessment of site conditions and design alternatives for Fiterman Hall (after the initial event horizon). Evaluated contaminant loading, air stream dispersal potential and biological contamination. Provided conceptual work plan to address the current hazards, emergency planning requirements, and future coordinated hazard mitigation.

Federated. Co-author of comprehensive pandemic planning document. Affected population (employee, management, contractor, customer) protocols developed.

US Postal Service (USPS), Various Locations, US. On-call consultant for biological risk evaluations and decontamination implementation. OSHA compliance audits, industrial hygiene surveys, particulate monitoring, engineering adequacy assessment, ventilation assessment, and data base development for USPS. Provided investigative scopes of work, conducted investigations, authored design analysis, provided specifications with cost analysis in order to complete biological decontamination projects. Provided on-going contractor oversight and produced close-out reports.

State of Nebraska, NE. Assessments of HVAC system design, facility usage, roofing adequacy, and emergency response considerations.

Former Fitzsimons Army Medical Center, CO – Planning and design survey (over one million square feet) to address chemical and biological contamination throughout the medical center.

Paul Davis Systems, NE. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Wacovia (Banks), GA. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Confidential Multi-National Clients Evaluated full suite of OSHA safety programs, emergency response, and industrial hygiene issues for due diligence associated with acquisitions. Emphasis on bloodborne pathogens, chemical exposure potential (VOCs, silica, asbestos, lead, isocyanates, hexavalent chromium), compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, ergonomics, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation in accordance with 29 CFR 1910.147 for industrial sites and 1926.417 for construction sites. Consideration, as appropriate, to 1910.269, 1910.306, 1910.333, and 1926.702. Verification sequence programmatic review included applicable and relevant OSHA standard to include NEC requirements. Consultant services with emphasis on chemical exposure potential and inherent hazards. Assessment of production areas, raw materials, equipment used, sustainability, and recycling. Database development.

US Army Corps of Engineers, Staff Industrial Hygienist. 1989 through 1998. Developed and implemented a comprehensive industrial hygiene monitoring program for employees of the US Army Corps of Engineers. Received Pesticide Applicators License, oversaw development of an integrated pest management database to track pesticides used and employees and contractors trained to use them. Maintain Medical Surveillance Program for Omaha, District Corps of Engineers for approximately 500 employees. Conduct and interpret Industrial hygiene air monitoring data, exposures included asbestos, hexavalent chromium, lead, mercury, volatile organic compounds, heavy metals, silica and welding fumes.

URS Corporation, Corporate Regional Safety Health and Environmental Manager, 1999 through present. Responsible for managing the occupational safety and health program for URS Employees including industrial hygiene monitoring, interpretation of results, and liaison for the medical surveillance program for between 100 to 400 employees (depending upon the organizational structure). Duties include collecting and interpreting industrial hygiene data for exposures including asbestos, lead, mercury, volatile organic compounds, heavy metals, silica and welding fumes.

Magellan Midstream Partners, CO, CT, DE, IA, KS, LA, MN, NE, OK, SD, TX, WI, 2005 through 2012: Developed and implemented a comprehensive industrial hygiene monitoring program for petroleum transportation, storage and distribution facilities. Performed industrial hygiene monitoring for hundreds of employees at over 40 facilities in 12 states. Developed a database for tracking and reporting data for parameters that include NORM, benzene, lead, hexavalent chromium, butadiene, hydrogen sulfide and dozens of other volatile organic compounds and particulates.

Confidential Client: China, Industrial Hygiene Services at sites located in the following countries; Hong Kong, Korea, Malaysia, Taiwan and USA. 2010 and 2011. Project Manager for comprehensive industrial hygiene services to evaluate exposures and determine medical surveillance protocols if any. Services included: conducting; a Qualitative Exposure Assessment (QEA), a Site-specific Industrial Hygiene Sampling and Analysis Plan (IHSAP), and Industrial Hygiene Quantitative Assessments (IHQA). 1) The QEA provided a documented, systematic evaluation and relative risk ranking of employee exposures to hazardous agents (chemical, physical, biological) during the execution of specific tasks within similar exposed groups (SEG) of workers. The QEA evaluated and summarized work place, work force and hazardous agent information and existing industrial hygiene data. 2) The site-specific IHSAP utilized information collected during the QEA conducted by URS, or by a QEA previously conducted by others. The IHSAP included the following:

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- Document process, specific products/raw materials, locations (e.g., mixer tank #2) during exposure assessments, as well as engineering controls, PPE usage, equipment calibrations.
- Collect additional information concerning each activity; cycle time (e.g., daily, weekly, monthly), generation rate (sporadic active, sporadic passive, daily active, daily passive, continual passive, daily active, continual active), number of employees involved in activity. Additional observation of work practices.
- Use NIOSH/OSHA analytical methods or regionally required/accepted methodologies
- Prepare a photographic log of activities and engineering controls associated with samples.
- Compare results to local regulatory standards and most current of American Conference of Industrial Hygienists Threshold Limit Values (TLVs)

URS then conduct area and personnel air monitoring (including hydrogen fluoride, and hexavalent chromium), noise dosimetry and other hazardous agent assessments representative of employee exposures for each SEG as indicated by the IHSAP.

Georgia Pacific/Dixie/Koch, 2007 to present, throughout US: Conducted Health, Safety and Industrial Hygiene Auditing. As part of a blended audit program where both 3rd Party auditors, in-house GP subject matter experts and GP EHS managers from other facilities conducted EHS audit at GP sawmill, pulpmills, Paper Plants, Corrugated Box Plants, Dixie Tissue and Paper Plates/Cups and other manufacturing facilities. Also, performed preparation audits for OSHA VPP. Audits included an assessment of machine guarding requirements.

Confidential Medical Centers and Laboratories, Various Locations, US. Provided comprehensive assessment, audit, and program implementation support. Items addressed included compliance with OSHA, DOT, EPA and local criteria for worker safety and correct management of chemicals, biologicals, and radioactive hazards. Compliance issue statements were coordinated with JCAO, NFPA, NEC, and other industry directives. Provided onsite determination of program effectiveness and worker compliance with required environmental, health, and safety initiatives. Clients have included major medical centers (DoD, DoI BIA, FDA, private, and non-profit), clinics, and assisted living facilities.

Product Stewardship/Integrated Pest Management

Georgia Pacific, Various Locations throughout the US and Canada

Throughout the accomplishment of the projects Dennis has evaluated chemical safety in relationship to human health and environmental consequence of chemical usage. In the United States this has included the development of Material Safety Database Sheets (MSDS) for industries producing chemicals and also the evaluation of MSDS for industries and governmental entities using chemicals.

Audited Integrated Pest Management Programs (IPM) and the effectiveness of the implementation of the IPM. Reviewed policies for setting action thresholds, monitoring and identification of pests using trend analysis techniques, prevention methods; including keeping pests out of the facility by sealing cracks, maintaining screens on windows and keeping doors closed; minimizing harborages, and control methods including effective use of traps and judicious use of pesticides.

Through toxicological profiling and analysis of physical risks, Dennis has developed adjunct chemical usage information sheets for these industries and governmental agencies. This profiling has included exposure scenario development based on analysis of potential risks associated with chemical usage and regulatory review to determine the impact of regulatory levels on controlling risk.

Past and current manufacturer's data on chemical usage, efficacy, and shelf life has been evaluated through the course of various projects. In European settings, this evaluation has included the criteria used in the Control of Substances Hazardous to Health (COSHH) standards approach. In the United States, this evaluation has included Occupational Safety and Health (OSHA), Environmental Protection Agency (EPA), and Department of Transportation (DoT) regulatory review. Under these regulations, the Consumer Product Safety (CPS), Food and Drug Administration (FDA), Toxic Substances Control Act (TSCA), and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provisions have been assessed and evaluated in terms of specific chemical manufacture and usage.

During the course of sustainability audits, Dennis has evaluated USFDA permits; Food Establishment Licenses; Food Permits; Food and Beverage Permits; Food and Drug Registrations, Registrations Under the Food, Drug, and Cosmetics Act; Federal Bioterrorism notifications, and Ethanol formulation notifications.

Risk assessments have also included evaluation of carcinogenic, mutagenic or toxic for reproduction (CMRs) considerations to determine chemical safety. In addition, chemicals that are persistent, bioaccumulative and toxic or very persistent and very bioaccumulative (PBTs/vPvBs) according to given criteria, and/or that give

rise to an 'equivalent level of concern' to those mentioned above where there is scientific evidence of probable serious effects to humans or the environment (e.g. endocrine disruptors) were identified on a case-by-case basis.

Chemical labeling, usage information, and recommendations for governmental agencies as to usage restrictions have been developed. When required, databases developed to track program implementation and compliance.

Asbestos/Lead Expertise; Landfill Remediation/Construction Oversight

Exide Lead Project, Los Angeles, CA, Client California Department of Toxic Substances Control: 2016 to present. Provide Quality assurance oversight of soil sampling and lead assessment contractors to support the cleanup of residential properties, schools, parks, daycare and childcare centers that have been impacted Exide former battery-recycling facility.

USACE and Inner Harbor Navigational Canal, New Orleans, LA Authored and reviewed a lead and asbestos survey for all properties located on Federal lands under the auspices of the Inner Harbor Navigational Canal. Survey included used and abandoned properties, barges, equipment, and environmental issues.

Former Nebraska Ordnance Plant, Mead, NE Safety Manager and CIH oversight of Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos abatement.

Billy Mitchell ANG Field, WI. Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal.

US Air Force Academy, CO. Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal.

NORAD (Cheyenne Mountain) CO. Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal.

Peterson AFB, CO Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal. Oversight of construction activities at landfill locations.

Former Hamilton AFB, CA Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal. Oversight of construction activities at landfill locations.

March AFB, CA. Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal.

Suisan Bay, CA Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal.

Fitzsimons Army Medical Center, CO – Asbestos design survey (over one million square feet), Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos, lead paint and hazardous waste abatement/removal. Also developed protocols for landfill excavations where hazardous wastes and biological contamination were present.

Power Plants and Dam Sites USACE CO, MT, NE, KS, MO, ND, and SD. Asbestos design survey, Design specification and drawing development, preparation of bid package, presentation of bid package, contract negotiations, Asbestos Hazard Abatement Plan approval, contractor compliance inspections for asbestos and lead paint abatement/removal. (1) Provided design, work plan review, and inspection of facilities for contractor compliance during asbestos work. (2) Provided industrial hygiene services consisting of evaluation of ventilation concerns and indoor air quality; OSHA compliance surveys, hazardous waste transfer and storage decisions, noise surveys, confined space surveys, OSHA and Army required safety and health training, and environmental regulation compliance surveys. (3) Implemented a complete Safety Program for all US Army Corps of Engineers workers.

USACE Missouri River Division Laboratory, NE. (1) Performed an OSHA compliance survey, ventilation studies as to volatile entrainment and leaded paint particulate air suspension, and comprehensive lead and asbestos survey. (2) Assessed compliance with 29 CFR 1910.1045. (3) Reviewed Chemical Hygiene Plan and provided new template. US Army Corps of Engineers –Conducted training in Asbestos/Lead Paint/Radon Awareness. US Army Corps of Engineers –Developed USACE manual for Asbestos Design and Management, Asbestos Hazardous Substance Removal, Asbestos Sampling.

Metropolitan Utility District (MUD) Omaha, NE. Project Manager for investigation and remediation of mercury contaminated soil and disposal of mercury gauge equipment at 15 locations.

USFDA, Various Locations, US. Project design, planning and oversight for mercury decontamination of FDA laboratories throughout the United States. Work included method adaptation of Turner's soil and sediment on-site analytical method for use in determining mercury content of biomass and rinsate solutions.

INAAP Assessment of mercury contaminant health and safety implications in soils at Indiana Army Ammunition Plant (INAAP).

Roosevelt Roads Naval Base, Puerto Rico. Assessment of mercury usage and needed protocol revisions at Roosevelt Roads Naval Base.

Power Plants and Dam Sites USACE CO, MT, NE, KS, MO, ND, and SD. Design analysis and protocol development for revisions to standard operating procedures for Missouri River Mainstem dams under the auspices of USACE.

Environmental, Health, and Safety (EHS) Auditing

Confidential Clients Meat Processing Facilities in AR, IA, NE, OK; EHS audits and Phase 1 Environmental Assessments.

Confidential Multi-National Clients Evaluated full suite of OSHA safety programs, emergency response, and industrial hygiene issues for due diligence associated with acquisitions. Emphasis on bloodborne pathogens, chemical exposure potential (VOCs, silica, asbestos, lead, isocyanates, hexavalent chromium), compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, ergonomics, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation in accordance with 29 CFR 1910.147 for industrial sites and 1926.417 for construction sites. Consideration, as appropriate, to 1910.269, 1910.306, 1910.333, and 1926.702. Verification sequence programmatic review included applicable and relevant OSHA standard to include NEC requirements. Regulatory review of US laws, EU directives RoHS/WEEE/REACH, ANSI standards, NFPA, NEC, and specific country regulations Assessment of the applicability of the three European Directives that are key elements of EU's environmental policy on chemical and waste management. Influence of these directives and local (country specific) legal acts were included in the comprehensive review. Future action plans were proposed in order to provide comprehensive and effective implementation of the

RoHS/WEEE/REACH at the facility and to aid in purchasing decisions given environmental, health, and safety needs at the facility. Consultant services with emphasis on chemical exposure potential and inherent hazards. Assessment of production areas, raw materials, equipment used, sustainability, and recycling. Database development.

Georgia Pacific/Dixie/Koch, 2007 to present, throughout US: Conducted Health, Safety and Industrial Hygiene Auditing. As part of a blended audit program where both 3rd Party auditors, in-house GP subject matter experts and GP EHS managers from other facilities conducted EHS audit at GP sawmill, pulpmills, Paper Plants, Corrugated Box Plants, Dixie Tissue and Paper Plates/Cups and other manufacturing facilities. Also, performed preparation audits for OSHA VPP. Audits included an assessment of machine guarding requirements.

Machine Guarding and Environmental, Health, and Safety (EHS)

Confidential Client, Poland. Evaluation of over 600 machines for machine guarding with design recommendation for upgrading. Regulatory review of EU, Polish, US laws, ANSI standards, NFPA, NEC, and Polish Norms. Industrial hygiene evaluation including personal protective equipment (PPE) hazard assessment. Database development, inventory control documentation, specifications, and purchase order development for metal and wood working machines. EHS audit. Emphasis on bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), and walking and working surfaces.

British Petroleum – Tbilisi Georgia. Industrial Hygiene and Safety Consultant for the Baku-Tbilisi-Ceyhan (BTC) Oil Pipeline. Mr. Day was responsible for development, implementation of industrial hygiene programs and health and safety auditing for a BTC construction project. Conducted a Quantitative Health and Safety Risk Assessment that included the following tasks:

- Identification and evaluation of physical hazards
- Collection, analysis of biological samples
- Collection and analysis of surface soil samples
- Screening of surface soils for radiological contamination
- Collection and analysis of surface water samples
- Collection and analysis of air samples to evaluate airborne contamination

Asbestos, Lead, Mercury, Volatile Organic Compounds, heavy metals, Silica and Welding Fumes.

Confidential Clients - Medical Facility Biological Assessment, Various Locations, US. Evaluation of operating room suites, equipment and supply areas, maintenance and vehicle use facilities, and general indoor air.

MidAmerican Energy, IA. Industrial hygiene area and employee exposure survey including exposure potential for chemical contaminants and noise. Asbestos air quality survey in areas known to contain asbestos insulation. Review and compilation of past data, and incorporation of new data onto database for electronic storage.

Syngenta, NE. Industrial hygiene assessment for noise and particulates.

GE Specialty Welding, KS. EHS compliance program development, industrial hygiene assessment, management and worker training, and environmental consultation. Ventilation assessment and engineering adequacy evaluation for input into design analysis and specifications. Emphasis on bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency

planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, walking and working surfaces, and welding.

Alcoa –Coal Powerplant, IL. Audited safety compliance during a remodeling project. Developed permit required confined space entry procedures.

Stanford Linear Accelerator Center (SLAC), CA. EHS assessment of SLAC facilities. Audits included industrial hygiene, emergency response, electrical safety, non-ionizing radiation safety, laser safety, excavation and trenching, and all other aspects of 29 CFR 1910.

Pfizer. Lincoln and Omaha NE. Participated with a Pfizer team in the Pfizer animal vaccine production facility audit in Lincoln, Nebraska audit. Audited Pfizer facility in Omaha, Nebraska – including the research and development section.

Lower Colorado River Authority (LCRA), TX. Provided comprehensive and interlinked planning and program development for GENCO (Power Generation - 40 retail utilities, including cities and electric cooperatives that serve more than 1 million people in 53 counties), WATERCO (Water Treatment and Distribution - 600-mile stretch of the Texas Colorado River between San Saba and the Gulf Coast), and GOC (central command). Safety program development including emergency response and compliance implementation assessments. Program audit of GENCO business line safety programs and program implementation at FPP. LCRA Safety assessment and program development for WATERCO and GOC business lines. Assessment included review of current program implementation and inspection protocols. Safety program development for both OSHA and industrial hygiene issues associated with WATERCO facilities. Facilities included power generation, coal-fired power plants, water treatment, wastewater treatment, and water distribution. Office complexes included maintenance and carpentry shops, large capacity office buildings, and paint shops.

Fayette Power Plant (FPP), TX. Comprehensive EHS compliance assessment focused audit of FPP to include power generation facilities, maintenance shops, transportation issues, general office environments. Provided Access database and interfaces for current electronic data bases to graphically portray safety and health information on the LCRA Intranet. Site-specific programs were interlinked with operations and maintenance and facility response plan requirements. The plans developed included emergency planning as a seamless document attendant to the overall safety planning and program development for LCRA.

LCRA Comal Plant, TX. Provided design, work plan review, and inspection of facilities for contractor compliance during lead abatement work. Provided industrial hygiene services consisting of evaluation of ventilation concerns and air quality; OSHA compliance surveys, hazardous waste transfer and storage decisions, confined space evaluations, OSHA and LCRA required safety and health training including fall protection, and environmental regulation compliance surveys. Scaffold design assessment for 11-story scaffold structure. Provided risk assessment calculations to determine adequacy of lead abatement.

GE Power Evaluated full suite of OSHA safety programs, emergency response, and industrial hygiene issues for due diligence associated with acquisitions. Emphasis on bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, walking and working surfaces, and welding. Confined space evaluations - both programmatic and implementation. Hazardous Energy Control evaluation in accordance with 29 CFR 1910.147 for industrial sites and 1926.417 for construction sites. Consideration, as appropriate, to 1910.269, 1910.306, 1910.333, and 1926.702. Verification sequence programmatic review included applicable and relevant OSHA standard to include NEC requirements.

GE Asset Management (GEAM) On-call biological risk consultant. Due diligence audits and indoor air assessments. GE Asset Management Audit of commercial and industrial properties. Emphasis on chemical exposure potential, hazard communication, and potential for on-going indoor air concerns.

GE Medical Due diligence consultation as to EHS compliance and program adequacy at potential GE acquisition facility. Evaluation of facilities for EHS, TSCA, and general facility adequacy given indoor air, fugitive emission CAA, and workplace safety requirements. Emphasis on bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), powered platforms, walking and working surfaces, and welding.

GE Capital Due diligence consultation as to EHS compliance and program adequacy at potential GE acquisition facility. Evaluation of facilities for EHS, TSCA, and general facility adequacy given indoor air, fugitive emission CAA, and workplace safety requirements.

Hertz, Various Locations US. EHS compliance assessment for vehicle/equipment maintenance, equipment rental and general office facilities. Review of current programs, training, and recordkeeping. Assessment of safety program implementation.

Kodak, Rochester NY. EHS and industrial hygiene compliance assessment for Kodak main campus Rochester NY. Review of current programs, training, and recordkeeping. Assessment of safety program implementation.

Scotts; CA, CO, IA, IL, OR, PA, SC; EHS and industrial hygiene compliance assessment for Scotts/Miracle Grow. Review of current programs, training, and recordkeeping. Assessment of safety program implementation.

Port of Houston Authority (PHA), Houston TX. Provided on-call consultant services. These services included industrial hygiene, environmental assessment, risk evaluation, and safety engineering consultation. Provided: Scopes of Work for PHA Safety Program Template Development, Environmental Site Assessments, Sample Crane Program Implementation Documents, Lead Hazard Assessment Documents, and Sample Water Safety Program Documents. In addition on-going document review and project oversight was provided for general contractor documents, Asbestos and Lead Hazard Abatement plans, and demolition projects. Conducted a Site Safety Reconnaissance and Limited Environmental Assessment for Grain Elevator #1 and provided scoping documents, sampling plans, and quality control oversight for investigations associated with pesticide use and spillage at another site. Addressed crane safety and fall protection issues through on-going communications with the PHA. Conducted regulatory reviews that assisted both the PHA and their contractors in implementing construction and industrial safety standards.

3M, NE. Clean Room Assessments - Responsible for investigative efforts to determine whether Clean Room standards have been attained. Provided design/construct alternative, and proposed operation and maintenance protocols to attain Clean Room status. Provided design/construct alternative, and proposed operation and maintenance protocols to attain Clean Room status.

Skyway Freight, NE. Indoor air quality evaluations and development of industrial hygiene protocols.

State of Nebraska, NE. Indoor air quality evaluations and development of industrial hygiene protocols.

Regency Builders, Mid American Claim Service, IA. Indoor air quality evaluations and development of industrial hygiene protocols.

Nebraska Warehouse, NE. Indoor air quality evaluations and development of industrial hygiene protocols.

City of Lincoln, NE. Indoor air quality (IAQ) evaluations - survey and evaluation to including use of vehicles and shipping routines, forklift operations, carbon monoxide evaluations and OSHA compliance per industrial hygiene issues.

Southeast Community College, NE. IAQ survey and evaluation of chemical and biological baseline.

Goodyear Tire and Rubber, NE. Industrial hygiene and safety survey including solvent exposure monitoring for printing operations.

Experian, NE. Industrial hygiene and safety survey including solvent exposure monitoring for labeling operations.

Mead Army Ammunition Facility, NE. Project Oversight - Provided CIH, CSP oversight to include Safety Management, site specific training, air monitoring protocol development and implementation supervision, analysis of site conditions during abatement, and preparation of site documentation. Prepared close out reports including Air Monitoring Report.

Hastings, NE. Nebraska Ordnance Pilot Project. Project Oversight - Provided CIH and CSP oversight during installation of monitoring equipment at Innovative Technology Pilot Plant designed to provide in-situ remediation of solvent plume. Conducted hazard assessment and provided input to USACE Kansas City District as to design efficacy of soil vapor extraction site (methane enhanced bioremediation) project.

Dannen Project, Hampton, IA. Pesticide breakdown product exposure assessment and litigation support Technical Consultant - Indoor Air Quality (IAQ) Monitoring for industrial, construction, insurance, and medical concerns. Provided information for litigation reports and to assist in the evaluation of Workers Compensation claims.

USACE Ellis Construction Oversight, MO. Ellis Construction Blue River Project. Environmental and OSHA compliance assessment for hazardous waste and construction work. Training of all personnel for current and future work construction efforts associated with hazardous wastes.

University of Nebraska (UNL), NE. OSHA programs review and development of comprehensive confined space program. Inventory and survey of all confined spaces to include digital photographic logs and evaluation of permit requirements. Consultant services for all UNL management decisions related to OSHA compliance and confined space program development.

USACE Missouri River Division Laboratory, NE. (1) Performed an OSHA compliance survey, ventilation studies as to volatile entrainment and leaded paint particulate air suspension, and comprehensive lead and asbestos survey. (2) Assessed compliance with 29 CFR 1910.1045. (3) Reviewed Chemical Hygiene Plan and provided new template.

Confidential Clients – Management audits, Various Locations, US. Audited management systems and current compliance auditing practices for confidential clients including medical equipment suppliers, vehicle transfer sites, plastic products manufacturers, construction equipment suppliers, metal working industries, aerospace industries, resin manufacturers, ammonium nitrate manufacturers, and ammonia suppliers.

Confidential Clients – Due Diligence, Various Locations, International. Due diligence auditing for refineries, petrochemical plants, manufacturing facilities, foundries, medical supply industries, waste water treatment utilities, water treatment facilities, and general industry. Conducted asbestos and lead based paint surveys, and prepared specification and scopes of work, and Site Safety and Health Plans for asbestos and lead abatement projects.

Confidential Clients – Public Utilities, Various Locations, US. Audited management systems at public utility sites throughout the United States. Audits included review of former compliance audits and auditing protocols as defined by programmatic documents. Conducted asbestos and lead based paint surveys, and prepared specification and scopes of work, and Site Safety and Health Plans for asbestos and lead abatement projects.

Confidential Clients – Educational Facilities, Various Locations, US. Second tier audit of educational institutions original audits and program evaluations. Presentation of findings to management, staff, and union boards. Conducted asbestos and lead based paint surveys, and prepared specification and scopes of work, and Site Safety and Health Plans for asbestos and lead abatement projects.

US Federal Government, Various Locations, US. Provided assessment of compliance audit efficacy at US Federal Government sites. Audits included review of government implementation of management systems and implementation of Lessons Learned information obtained from prior audits.

Roosevelt Roads Naval Air Station, Puerto Rico. Audited materials management protocols and environmental regulatory compliance. Audit included assessment of prior audit and current auditing protocols to assure Pollution Prevention goals were achieved.

Indiana Army Ammunition Plant (INAAP). Audited health and safety, environmental hazards, and process status at. Provided risk assessment coding matrices and access database to track site status.

Combustible Dust Studies: Confidential International Clients Audited facilities world wide per OSHA NEP and local country regulations Grain Elevators and Cooperatives (Confidential Client) NE and IA Evaluated combustible dust associated with transfer and storage of grain. Scotts CA, GA, IA, IL, MI, OH Evaluated combustible dust associated with use of manure, chicken litter, and ammonium nitrate based fertilizers. Agrium, NE and KS Evaluated combustible dusts associated with ammonium nitrate production. Port of Houston, TX Evaluated combustible dust associated with storage in largest grain elevator complex in US. Evaluated treatment of dust with mineral oils. Gypsum Board Manufacturer (Confidential Client) IA Evaluated combustible dust associated with additives to Gypsum Board. Trace Minerals Manufacturer (Confidential Client) US Evaluation of combustible and electrically conductive dusts. USPS various locations throughout the United States Evaluated combustible dusts associated with airborne cellulose paper fibers. MidAmerican Energy, IA. Industrial hygiene area and employee exposure survey including exposure potential for chemical contaminants combustible coal dust. Lower Colorado River Authority (LCRA), TX GENCO Fayette Power Plant (FPP) and other GENCO sites, Industrial hygiene area and employee exposure survey including exposure potential for chemical contaminants combustible coal dust. Due Diligence Evaluation Red River Redevelopment Authority TX Evaluated combustible dust residual in coal fired Power Plant. Indiana Army Ammunition Facility, IN Evaluated combustible dust residual associated with nitrocellulose production. NOAA Post Katrina, Gulf Coast evaluation of combustible dusts associated with solid waste residuals. FEMA Responder World Trade Center, NY. Evaluated contaminant loading, air stream dispersal potential and contamination associated with residual dusts from various sources. British Petroleum – Tbilisi Georgia. Health, Safety and Biological Risk Assessment Consultant for the Baku-Tbilisi-Ceyhan (BTC) Oil Pipeline. Mr. Day was responsible for developing and conducting a safety, health and biological risk assessment for the Landfill Conditioning Plan at the Iagluja Landfill. Confidential Client, IL Evaluated combustible foundry dusts (aluminum, magnesium). Alcoa Evaluated combustible coal dust.

Emergency Response

USACE, Homestead FL. Industrial Hygiene and Health and Safety Support during hurricane relief efforts. Received the Civilian Achievement Metal as recognition of efforts.

USACE, Various Locations, US. Lead industrial hygiene and Safety Investigator for Headquarters US Army Corps of Engineers. Investigations detailed effectiveness of contingency and emergency response activities in the Omaha District.

US Army Desert Shield and Desert Storm. Detailed to Ft. Carson under the War Powers Act. Accelerated investigation, design, specification, contractor oversight, and accelerated rehabilitation of facilities. Activities at the Ft. Carson troop and equipment facility. Response was to rehabilitate areas of Ft. Carson to accept troop contingents.

USACE, Various Locations, US. Emergency Response - Chemical Warfare Materials (CWM) - Investigated and documented presence (or lack) of CWM contamination. Response included auditing of contractor presence and site activities.

USACE Walla Walla, WA. Emergency Response - Investigated contamination at the construction headquarters site in Washington State. Initiation of immediate response Site Safety and Health Plans and coordination of all site activities.

Power Plants and Dam Sites USACE CO, MT, NE, KS, MO, ND, and SD. Response included supervision and clean-up activities in addition to initiation of contact documents (specifications and plans). Suisan Bay Naval Ship Yard, CA. Immediate Response and Contaminate Investigation- Suisan Bay Naval Ship Yard. Response required Level C entry into ship holds contaminated with a variety of wastes to investigate needed contractor response. Provided technical portions of specifications based on investigative results.

USACE, Various Locations, US. Technical review of immediate and Rapid Response actions performed by USACE Omaha. Safety Officer tasked with auditing all such actions for hazardous and toxic waste sites. Author and reviewer for emergency and contingency plans generated for US EPA, US Army, and US Air Force sites throughout the United States. Author of emergency response protocols where Hazardous, Toxic, and Radioactive Wastes (HTRW) were of concern.

Former Black Hills Army Depot, SD. Primary author of the Black Hills Protective Action Plan, an emergency and contingency planning document. Provided coordination between USHND Center of Expertise for Unexploded Ordnance, USACE Omaha for HTRW concerns, Missouri River Division Laboratory, locate emergency providers, US Geological Service personnel, local government officials, US. Army Center for Health Promotion and Preventative Medicine (USACHPPM), contractors, and Aberdeen Proving Ground air monitoring and emergency response teams.

USACE, Various Locations, US. Industrial hygiene consultant - for all projects where GB (Sarin), VX, Mustard Agent, and Lewisite or their respective breakdown products were potential contaminants of concern. These services included review of Site Safety and Health protocols, programs, plans, and on-site field oversight/monitoring. Conducted and reviewed on-site monitoring using I-Cam and Mini-Cam instrumentation. Determined contractor fitness for work on sites potentially contaminated with Chemical Warfare Materials. Conducted briefing sessions for US Army Corps of Engineer personnel assigned to work at RMA. Provided liaison services between the Omaha District and Huntsville Division for sites where sites involved CWM and ordnance.

Biological Vulnerability Assessments, Planning, and Decontamination

Midwest Laboratories, NE. Established team approach with Midwest Laboratories for client's industrial hygiene needs, including gas/vapor monitoring, liquid/solid sampling, and biological monitoring. *Legionella* assessment for confidential industrial client to include sampling and interpretation of risk associated with cooling towers and standing waters. *Stachybotrys* investigation for multiple residential clients in association with health condition etiology determination. *Aspergillus*, *Penicillium*, and General Mold/Fungi Contamination Assessments for confidential industrial clients, schools, and residential clients.

Confidential Industrial Clients, Various Locations, US. Due Diligence Biological Risk Assessment: Developed assessment protocols, management protocols, and decontamination routines for Phase II facility assessment of an office complexes, hotels, restaurants, and heavy industry sites. Provided initial assessment and diagnosis of biological contamination causation and the potential for decontamination. Evaluated heating ventilation and air conditioning (HVAC) equipment and supply areas, maintenance and facilities, and general indoor air.

Confidential Clients *Legionella* assessments Sampling and interpretation of risk associated with cooling towers and standing waters. Microbiological monitoring and ventilation studies with emphasis on engineering control and sanitation requirements.

US Federal Government, Various Locations, US Biological Risk Assessments and Decontamination Specifications: Developed assessment protocols, construction specifications, construction management protocols, and decontamination routines for facility remediations of US government, medical, industrial, residential, and commercial sites. Performed Microbiological Monitoring and Ventilation Studies with

emphasis on engineering control and sanitation requirements to include gas/vapor monitoring, liquid/solid sampling, and biological monitoring.

Confidential Clients – Insurance Agencies, Various Locations, US. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Confidential Clients - Medical Facility Biological Assessment, Various Locations, US. Evaluation of operating room suites, equipment and supply areas, maintenance and vehicle use facilities, and general indoor air.

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles. CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

FEMA Responder World Trade Center, NY. Provided assessment of site conditions and design alternatives for Fiterman Hall (after the initial event horizon). Evaluated contaminant loading, air stream dispersal potential and biological contamination. Provided conceptual work plan to address the current hazards, emergency planning requirements, and future coordinated hazard mitigation.

Federated. Co-author of comprehensive pandemic planning document. Affected population (employee, management, contractor, customer) protocols developed.

US Postal Service (USPS), Various Locations, US. On-call consultant for biological risk evaluations and decontamination implementation. OSHA compliance audits, industrial hygiene surveys, particulate monitoring, engineering adequacy assessment, ventilation assessment, and data base development for USPS. Provided investigative scopes of work, conducted investigations, authored design analysis, provided specifications with cost analysis in order to complete biological decontamination projects. Provided on-going contractor oversight and produced close-out reports.

State of Nebraska, NE. Assessments of HVAC system design, facility usage, roofing adequacy, and emergency response considerations.

Former Fitzsimons Army Medical Center, CO – Planning and design survey (over one million square feet) to address chemical and biological contamination throughout the medical center.

Paul Davis Systems, NE. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Wacovia (Banks), GA. Conducted assessments with standardized site-specific assessment protocols; conducted on-site assessments, provided status report.

Chemical Risk and Vulnerability Assessments

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles. CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

FEMA Responder World Trade Center, NY. Provided assessment of site conditions and design alternatives for Fiterman Hall (after the initial event horizon). Evaluated contaminant loading, air stream dispersal potential and biological contamination. Provided conceptual work plan to address the current hazards, emergency

planning requirements, and future coordinated hazard mitigation. Addressed vulnerability probabilities for decontamination, rehabilitation, future occupancy, demolition, and abandonment in place.

Pueblo Army Activity, CO. Assisted in determining risk assessment assumptions, model parameters, statistical test results, spreadsheet formatting, toxicological effect summarization, fate and transport reporting, and risk summarization including prediction of potential vulnerability. Provided design alternatives and review, constructability review, environmental compliance review, preparation of Part B permit litigation file, completion and presentation of in-house risk assessment, and industrial hygiene/Safety consultant services. Provided risk assessment for 1,3,5 TNB. Provided ongoing risk assessment profiles to assist in the reevaluation of explosive chemical breakdown products.

Rocky Mountain Arsenal, (RMA) CO. Responsible for data evaluation, toxicology, uncertainty analysis, vulnerability assessments, risk management, risk communication, exposure assessments, screening level risk assessments, and review and revisions of ecological risk assessments. Risk Based Design and Risk Management planning for the decommissioning of the Hydrazine Blending Facility, requiring an extraordinary amount of risk based design calculation due to the presence of hydrazine, hydrazine break-down chemicals, UDMH, NDMA, aerazine, ethylene glycol, and asbestos (often laced with the other contaminants); holding ponds contained an undefined chemical mix. Reviewed and initiated Risk Management decisions for the Lime Settling Basin (mustard agent neutralization site) and RCRA facility for the destruction of Basin F contaminant waste streams. On site consultant for Risk Management decisions at the North Boundary CERCLA Water Treatment Facility and in numerous investigative efforts.

Former Black Hills Army Depot, SD. Risk assessor and risk management industrial hygienist with primary responsibility for the development of the components of the Safety Submittal. Facilitated Risk Management via coordination meetings and training sessions.

Confidential Clients, Various Locations, US. Pesticide risk evaluation and expert witnessing for agribusiness and residential clients. Investigations include empirical sampling, toxicological evaluations in coordination with medical personnel, and preparation for courtroom deliberations.

Confidential Clients, Various Locations, US. Baseline risk assessment at RCRA regulated operating facilities, including risk assessment evaluation of human health and environment risk caused by release of heavy metals (cadmium, lead) to soil and groundwater. Performed baseline risk assessment of a RCRA facility following release of VOCs to subsurface soils and shallow groundwater.

Remediation Design and Oversight

FDA Laboratory Decommissioning - New Orleans, LA; Dallas, TX, New York, NY; Baltimore, MD; Minneapolis, MN; Chicago, IL, Detroit, MI, Los Angeles. CA. Provided Work Plan, Asbestos Abatement Plan, Site Safety and Health Plan, Sampling and Analysis Plan, Quality Control Plan, and Waste Plan for all contractor activities. Supervised investigative and decommissioning efforts that included biological contaminants (mold and bacteria), dioxins and furans, mercury, PCBs, lead, asbestos, and hazardous waste removal from laboratory interiors and waste containment areas. Authored Decommissioning Report detailing sequential decontamination efforts and release of the property to prior owners or GSA.

Exxon Mobile, LA. Post Katrina and Rita Hurricanes - New Orleans LA. Remedial design consultant and estimator. Developed assessments for rehabilitation of commercial facilities. Provided cost estimates, design documents, and plans for decontamination of facilities and retrofitting for renewed usage. Oversight of biological and chemical decontamination efforts; including those to rehabilitate HVAC systems.

NOAA, Pascagoula, MS. Design consultant and estimator. Developed assessments for rehabilitation of NOAA facilities. Provided cost estimates, design documents, and plans for decontamination of facilities and retrofitting for renewed usage. Oversight of biological and chemical decontamination efforts.

NOAA; Princeton, NJ. Design consultant and estimator. Developed assessments for rehabilitation of NOAA facilities. Provided cost estimates, design documents, and plans for abatement of facilities and retrofitting for renewed usage. Oversight of construction efforts; including those to rehabilitate HVAC systems.

NE Air National Guard, NE. Author of Site Safety and Health Plans. Investigative work at the NE Air National Guard Jet Fuel Storage Complex POL-4 tank.

Lincoln Water System, NE. Investigative work associated with spillage of fluosilic acid at a Lincoln Water System facility. On-site safety and health officer for initial site work related to Alternate Confined Space investigative efforts.

Power Plants and Dam Sites USACE CO, MT, NE, KS, MO, ND, and SD. Design Consultant - US Army Corps of Engineers Power Plants and Lake Offices. Provided design, work plan review, and inspection of facilities for contractor compliance during asbestos work. Provided industrial hygiene services consisting of evaluation of ventilation concerns and indoor air quality; OSHA compliance surveys, hazardous waste transfer and storage decisions, noise surveys, confined space surveys, OSHA and Army required safety and health training, and environmental regulation compliance surveys. Implemented a complete Safety Program for all US Army Corps of Engineers workers.

Rocky Mountain Arsenal, CO. Provided innovative design package, plan review, field oversight, and consultant industrial hygiene services for the remediation of a site contaminated with hydrazine, UDMH, aroclor, ethylene glycol, and asbestos. Reviewed waste stream profiles and permit requirements. Industrial hygiene design team representative for quench furnace Part B remediation design/construct, slurry wall installation, basin remediation, groundwater treatment facilities, and decommissioning of on-site buildings. Design development and oversight included development of protocols for construction landfill excavations and toxicological assessments with resultant protocol development for trenching to determine location of energetics and agents. Follow on design packages included landfill issues associated with excavation of Basin F and Basin A; to include remedial efforts during the excavation; construction safety; and permit compliance assessment.

Pueblo Army Depot, CO. Provided innovative design package, plan review, field oversight, and consultant industrial hygiene services for the remediation of a site contaminated with TNT and TNT breakdown products. Industrial hygiene design teams representative for evaluation of cryogenic treatment of mustard agent. . Industrial hygiene design team representative for groundwater treatment facilities, excavation of TNT contaminated soils, and decommissioning of on-site buildings. Design development and oversight included development of protocols for construction landfill excavations and toxicological assessments with resultant protocol development for trenching to determine location of energetics and agents.

Sauget (Area 2 Site Groups) IL EPA Site – Author of EPA Level B training materials.

Pollution Prevention and Hazardous Waste Minimization

Roosevelt Roads Naval Base, Puerto Rico Developed pollution prevention incentive document after review of current hazardous and solid waste stream at the United States largest naval base complex. Provided technological alternatives and waste stream minimization provisos for consideration by the base and submittal to EPA. Plan included analysis of petroleum hydrocarbon usage as well as painting; solvent; mercury, NiCad, and gel battery; antifreeze; alodine; fluorescent, halogen, and incandescent lights, filter; rags, asphaltic; concrete; medical; and maintenance shop wastes.

Training/Guidance Document Development

Confidential Client Poland. Developed and presented comprehensive OSHA type training program. Topics included bloodborne pathogens, chemical exposure potential, compressed gas usage and storage, confined space, cranes & hoists, emergency planning & fire protection (life safety codes), hazard communication, use of

tools, flammable and combustible materials use and storage, machine guarding, medical and first aid response (including eyewash use), noise exposure evaluation, personal protective equipment (including respirators), and walking and working surfaces.

AIHA Conference, CA. Biological Risk – Decontamination training for the ABIH at the 2002 CIH conference. Advanced training (16 hour) for professional development course (PDC).

US Air Force. Dyess AFB TX. Department of Transportation (DoT) Hazardous Materials Training: Training provider to the Air Force to present DoT training as required by 49 CFR, Part 172.704, and also referred to as HM-181 or HM-126.

Minot AFB, ND. Spill Prevention Control Planning and HAZWOPER Supervisor Training, Minot AFB Provided integrated emergency planning training to address National Contingency Plan and Executive orders relevant to chemical management and incident response.

Con Agra, NE. Risk Management Program/Plan and Process Safety Management training.

Nebraska (Federal) OSHA, NE. Developed and taught the industrial hygiene for Safety Professionals. 24-hour course presented to Iowa OSHA and Nebraska Department of Labor safety professionals and industrial hygienists. Course included the basic rubrics of industrial hygiene including toxicology, air monitoring, industrial point sources, ventilation, and assessment of workplace risk.

University of Nebraska Continuing Education, NE. HAZWOPER training: Training provider for industrial and construction firms in 40 and 24 hour HAZardous Waste Operations and Emergency Response (HAZWOPER).

Various Confidential Clients. Industrial Training: Custom designed industrial training programs including implementation training for management and workers for all OSHA compliance programmatic issues to include Respiratory Protection, Hazard Communication, Bloodborne Pathogen, and Hearing Conservation. Industrial training provided for multiple clients through out the US.

USACE, Omaha NE. Developed and taught the Omaha District Safety and Occupational Health Training Program: 40 hour Hazardous Waste Operations Training, 8 hour Refresher Training, and other Safety and Health Awareness courses including Respiratory Protection, Hazard Communication, Bloodborne Pathogen, Asbestos/Lead/Radon Awareness, Hearing Conservation, and Safety and Health Awareness at HTRW Sites.

USACE, Omaha NE. Omaha District Safety and Health Program - Prime contributor to development of program which included Respiratory Protection, Personal Protective Equipment, Confined Space, Bloodborne Pathogen, Medical Surveillance, and other programs to guarantee compliance with 29 CFR 1910.120.

USACE, Omaha NE. Reviewed, and provided industrial hygiene consultant services to promote technically acceptable Scopes of Work/Services, Pre-Design research and documents, and Design Documents (Design Analysis and Specifications). Provided in Safety documents including Contaminant of Concern, Hazard Analysis, and Risk Assessment sections.

USACE, Omaha NE. Interpreted regulations that impacted worker safety and health, as well as environmental concerns (remediation goals, off-site contaminant migration potentials, and their implications). Provided advice regarding Safety and Health specification compliance, construction design implementation alternatives, and regulatory issues at pre-construction meetings.

USACE, Omaha NE. Reviewed and recommended CE USE codes for Site Safety and Health Plans, Asbestos Removal and Disposal Plan, Work Plans, Plans of Operations, and others. Reviewed and wrote Health and Safety Design Analysis (HSDA), HTRW Technical Specifications - Health and Safety, and Asbestos Removal and Disposal Specifications to ensure compliance with safety and health regulations.

USACE, Omaha NE. Developed Guidance Documents for Quality Assurance/Quality Control, Sample Shipment, and Waste Disposal. Design guidance for the USACE-Omaha Design Branch and industrial hygiene section.

Radiation – Ionizing and Non-Ionizing

Provided comprehensive assessment, audit, and program implementation support. Items addressed included compliance with EPA, DOE, DOT, OSHA, and local criteria for management of chemicals, biologicals, and radioactive hazards. Clients have included major medical centers (DoD, DoI BIA, FDA, private, and non-profit) facilities.

Mueller Corporation; 2010 to present; Conducted Machine Guarding Risk Assessments for more than 1,000 machines at manufacturing and foundry locations in the USA.

Radiation – Nonionizing and Electro-Magnetic Field Studies

Confidential Client - Evaluation of EMF associated with access point, desk top computers, laptop computers, iPad, cellular phones and other handheld communication devices.

Assisted with design and implementation of the study for the pre-installation EMF measurements. Evaluated environmental electromagnetic field generated by use of electric railways.

Conducted pre- and post-startup EMF onsite data collection, analyzed the data, interpreted the results, and made recommendations based on the data in compliance with International and California EMF standards.

Radiation Safety Officer USACE 1989 to 1998

Served as Radiation Safety Officer for the USACE Omaha District. Conducted wipe sample on sources, conducted radiation safety training.

Professional Societies/Affiliates

American Industrial Hygiene Association 155384

Diplomat of the American Academy of Industrial Hygiene

Indian Country Environmental Hazard Assessment Project (ICEHAP)

Global Engineers

Awards

1. Achievement Metal for Civilian Service, US Department of the Army, for work performed September and October 1992 in support of the Hurricane Andrew Recovery Operations.
2. Memorandum of Appreciation for training in support of ICEHAP program, Crow Nation 2003.
3. Memorandum of Appreciation US Army Corps of Engineers and US FDA for work performed 1998 through 2004. Seven top ACAS ratings.
4. Memorandum of Appreciation for design/construct and 15-site RCRA Facility. Investigation, Pueblo Depot Activity, CO, Department of the Army, Kathryn M. Shenk, P.E., Chief HTW Branch, Programs and Project Management Division. November 3, 1994. Teamwork Noted Outstanding Work, for design/construct and 15-site RCRA Facility Investigation, Pueblo Depot Activity, CO, Department of the Army

Specialized Training

1. Industrial Hygiene, Harvard School of Public Health, Department of Environmental Science and Physiology, Boston, MA, Oct, 1990
2. Measurement Techniques in the Industrial Environment Harvard School of Public Health, Department of Environmental Science and Physiology, Boston, MA, Nov. 1990
3. Basic Health Physics (Louisiana State University), Dec. 1989
4. Risk Assessment Guidance for Superfund, USEPA
5. Lead Paint Inspector Course (Georgia Tech), Feb. 1992
6. Respiratory Protection Training, Nov. 1992

7. Principles of Ground Water Hydrogeology, National Water Well Association (NWWA)
8. Environmental Laws and Regulations, Sept. 1994
9. Environmental Risk Assessment, Nov. 1994
10. Principals of Toxicology (University of Cincinnati), July 1995
11. OSHA Hazardous Waste Site Activities Training, LAW Environmental
12. Advance Resource Conservation and Recovery Act (McCoy and Associates), Oct. 1995
13. Hazardous Materials Transportation, Sept. 1993
14. Trenching and Excavation Safety
15. Asbestos Contractor/Supervisor, Inspector, Designer courses (Georgia Tech), April 1991
16. AHERA Project Designer and Contractor/Supervisor
17. OSHA Hazardous Waste Site Activities Training
18. National Electric Code 2005 Training, National Technology Transfer Inc.
19. Indian Country Environmental Hazard Assessment Project (ICEHAP)

Publications and Presentations

1. Publication: Mercury Regulations. Facility Care Magazine, January 1999.
2. Book: Co-author, editor; Air Sampling and Industrial Hygiene Engineering, ISBN/ISSN 1-56670-417-0 CRC Press, December 2000
3. Book: Co-author, editor; Biological Risk Engineering Handbook. ISBN/ISSN 1-56670-606-8 CRC Press, December 2002
4. Book: Co-author, editor; Building Vulnerability Assessments: Industrial Hygiene and Engineering Concepts; ISBN 9781420078343 - CAT# 78348; CRC Press, 2009
5. Book: Contributor; Electrical Safety: Systems, Sustainability, and Stewardship, ISBN-13: 978-1482230178 ISBN-10: 1482230178, CRC Press, October 29, 2014.
6. Book: Co-author, editor; Handbook of Chemical Regulations: Benchmarking, Implementation, and Engineering Concepts; ISBN 9781498717793 - CAT# K25449 CRC Press, 2015

Chronology

AECOM, Principal Toxicologist- March 1999 – present

United States Army Corps of Engineers, Senior Industrial Hygienist, Engineering Division, 1995 – March 1999

United States Army Corps of Engineers, Industrial Hygienist - Safety Office, September 1989 –1995

Contact Information

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Omaha, NE 68154

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Fax: 402-334-1984

Email: Dennis.Day@aecom.com

Americas

Competent Person Designation

S3AM-202-FM1

Company: _____	AECOM Manager: _____
Project Location: _____	Program/ Project No: _____
Designated Competent Person: _____	Employee No: _____

Check the technical activity for which the Designation will apply:

<input type="checkbox"/> Asbestos <input type="checkbox"/> Assured Equipment Grounding Conductor <input type="checkbox"/> Blasting & Explosives <input type="checkbox"/> Concrete & Masonry Construction <input type="checkbox"/> Confined Space Entry <input type="checkbox"/> Control of Hazardous Energy (Lockout/Tagout) <input type="checkbox"/> Crane Assembly / Dissassembly <input type="checkbox"/> Cranes & Derricks <input type="checkbox"/> Demolition <input type="checkbox"/> Electrical Wiring Design & Protections <input type="checkbox"/> Elevated work platforms & aerial lifts <input type="checkbox"/> Fall Protection <input type="checkbox"/> Hearing Protection	<input type="checkbox"/> Heavy Equipment <input type="checkbox"/> Ionizing Radiation <input type="checkbox"/> Lead <input type="checkbox"/> Material Hoists & Personnel Hoists <input type="checkbox"/> Respiratory Protection <input type="checkbox"/> Rigging Equipment <input type="checkbox"/> Scaffolds <input type="checkbox"/> Silica <input type="checkbox"/> Stairways & Ladders <input type="checkbox"/> Steel Erection <input type="checkbox"/> Trench & Excavations <input type="checkbox"/> Underground Construction <input type="checkbox"/> Welding & Cutting
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Other (Explain):

The AECOM employee identified has been designated as the Competent Person in the technical area specified by the responsible manager (e.g. Project Manager, Operations Manager, Superintendent) identified. This designation is based on the following:

1. The responsible manager is authorizing the Competent Person to allocate whatever resources that are necessary to perform tasks associated with the area of competency to provide a safe work environment and comply with applicable regulatory and legislative requirements, and AECOM SH&E procedures and policies.
2. The Responsible Manager has confirmed that the individual is competent to perform the required tasks by way of:
 - a. Documented training
 - b. Practical experience (hands-on)
 - c. Documented professional experience
 - d. Legislative knowledge

Print name and sign below

Designated by: _____ (AECOM Manager)	Date: _____
Designated by: _____ (AECOM SH&E Manager)	Date: _____

Comments:

Attach any related documentation of training, certifications, insurance coverages, or other related information that supports the designation of the person as Competent.