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September 26, 2013

Mr. David Szymanski
Project Manager
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 11th Floor
Albany, NY 12233-7011

RE: Revised Corrective Measures Work Plan
Mineral Springs Road Former Manufactured Gas Plant Site

Dear Mr. Szymanski,

On behalf of National Fuel Gas Distribution Company (NFG), AECOM is submitting this revised Corrective Measures Work Plan (CMWP) for the Fence Replacement Area at the Mineral Springs Road Former Manufactured Gas Plant Site. The work plan has been revised based on comments to the draft CMWP received from NYSDEC and NYSDOH.

If you have any comments or questions regarding the responses or the revised CMWP, please call Brad Walker at 716-667-5559 or me.

Regards,

Thomas P. Clark, P.E.
Senior Engineer

cc: B. Walker – NFG
T. Alexander – NFG
S. McLaughlin – NYSDOH
T. Raby, AECOM

AECOM Environment

Prepared for:
National Fuel Gas

Prepared by:
AECOM
Chelmsford, MA 01824

September 25, 2013

Corrective Measures Work Plan
Fence Replacement Area

Mineral Springs Road Former Manufactured Gas Plant Site
West Seneca, New York

AECOM Environment

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Corrective Measures Work Plan
Fence Replacement Area

Mineral Springs Road Former Manufactured Gas Plant Site
West Seneca, New York

_____
Prepared By Thomas P. Clark, P.E.

_____
Reviewed By Tamara Raby, Project Manager

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List of Acronyms

µg/m^3	micrograms per cubic meter
CAMP	Community Air Monitoring Plan
CMWP	Corrective Measures Work Plan
HASP	Health and Safety Plan
MGP	Manufactured Gas Plant
NFG	National Fuel Gas
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operations and Maintenance
PID	photoionization detector
SVOCs	Semivolatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
VCA	Voluntary Cleanup Agreement
VOCs	Volatile Organic Compounds

1.0 Introduction

This document presents the Corrective Measures Work Plan to address suspected purifier box waste materials observed along the western property boundary. This work plan is in response to the New York State Department of Environmental Conservation's (NYSDEC) letter dated July 22, 2013.

2.0 Background

National Fuel Gas' (NFG's) Mineral Springs facility at 365 Mineral Springs Rd, in West Seneca, New York (Site), is the former site of a manufactured gas plant (MGP). A remedial action to address MGP residues in soil was completed in 2001. In June 2013, as part of security upgrades at the facility, new perimeter chain-link fencing was installed along the western site boundary and southwestern corner. NFG hired an environmental contractor to drill the fence post holes. The fence post drilling was performed between June 24 -28, 2013. On June 26, 2013 suspected purifier box wastes were encountered while advancing four new fencepost holes near the southwestern corner of the Site. These locations, shown on Figure 1, are within NFG's property boundaries.

NFG immediately notified NYSDEC of the materials encountered. All suspect materials encountered in the fence post holes were placed in a single new 55-gallon drum for subsequent sampling and disposal.

On July 19, 2013 the NYSDEC notified NFG of a citizen's complaint regarding the presence of blue waste material on NFG property, behind the residents' property on Calais Street. This material appeared to result from the fence installation process. NFG's spill response contractor responded to the site, removed the material, placed it in a single new 55-gallon drum, and the area was covered with plastic sheeting pending further evaluation. A NYSDEC representative was present on site to observe this work.

An additional complaint was received on July 25 from another resident on Calais Street, indicating more suspect material found on NFG property, adjacent to the resident's property. This area was also covered with plastic sheeting. A NYSDEC representative was present on site to observe the additional area and suspect materials on July 25.

In response to these events and consistent with the provisions of NFG's Voluntary Cleanup Agreement (VCA number B9-0538-98-08), the 2002 Operations and Maintenance (O&M) Plan, and the Deed Restrictions, NFG has prepared this Corrective Measures Work Plan (CMWP).

3.0 Environmental Conditions

Suspected purifier wastes were encountered during new perimeter fence installation in June 2013. The locations where these fence posts were installed are shown on Figure 1. Following observation of blue green stained soil during and following fence post installation, NFG inspected the fenceline and identified areas of concern where impacts are visible. These areas are shown on Figure 2.

4.0 Proposed Remedial Action

4.1 Site Preparation

Site preparation activities will include installation of temporary fencing, installation of erosion and sediment controls, surveying to establish baseline conditions and grades, utility location and protection, and clearing of vegetation. Dust control will be implemented including wetting soils with water, limiting the size of open excavations, covering unprotected soils with plastic sheeting or foam, and stopping excavation during periods of high wind.

4.2 Description of the Corrective Measure

Site restoration measures including re-grading the area between the new fence and NFG property boundary were scheduled as part of the original perimeter fence replacement. These measures were originally planned to maintain the natural southward flow of runoff and reduce pooling of water during the spring time and wet weather events. These re-grading efforts will be implemented as part of the environmental evaluation of this area and corrective measures to remove suspected purifier wastes.

A drainage ditch will be excavated approximately two feet from the property boundary (on NFG property), from the northern limit of the area of concern southward to the existing drainage feature in the southwest corner of the property. This drainage ditch will maintain the current overland runoff flow direction and to eliminate pooling during wet weather events. The ditch will be finished as a french drain with 4-inch perforated drain pipe set in a clean stone bedding as shown on Figure 3.

During all intrusive activities, site soils will be observed for the presence of suspected purifier wastes and screened with a photoionization detector (PID). All excavated soils, unless determined to be native and unimpacted, will be characterized, and properly disposed of off-site. If suspected purifier wastes are encountered, these materials will be excavated and removed to a depth of two feet below final grade. To prevent undermining of the newly installed fence, excavations will not exceed two feet below final grade. NFG will attempt to delineate the area of additional impacts to the extent practical without undermining the fence. Any remaining suspected purifier wastes will be capped in accordance with the Remedial Design / Work Plan (RETEC, 1998). A cap will be constructed consisting of a nine-inch minimum clay layer covered with either a three-inch topsoil cover or geotextile fabric and landscape stone.

In addition, surface soil with visible green staining at the southwest area proximal to the National Grid electric tower will be excavated to a maximum depth of one foot. Soils will not be excavated proximal

to sensitive utilities and storm sewer structures. Areas excavated will be backfilled with appropriate material. The surface will be finished covering with geotextile and stone or with topsoil and seed. If suspected purifier wastes are encountered at a depth greater than one foot, a nine-inch clay cap will be constructed as described previously.

4.3 Confirmatory Sampling

Following implementation of the corrective measure and before placement of drainage stone and pipe, confirmatory samples will be collected along the Calais St. (West) side of the property line and the south side of the property within the areas of concern shown on Figure 2 at a frequency of one sample for every 30 feet consistent with the requirements of NYSDEC's DER-10 / Technical Guidance for Site Investigation and Remediation. The length of this area on the western property line is approximately 380 feet and an estimated 13 samples will be collected. The area of concern along the southern side of the site is approximately 30 feet so one sample will be collected there. Samples will be collected from 0 to 0.5 feet below ground surface (bgs) and analyzed for total cyanide, mercury, and arsenic.

Confirmatory samples collected will be analyzed using the following laboratory methods:

- Arsenic - EPA Method 6010
- Total cyanide - EPA Method 9010/9014
- Mercury - EPA Method 7471

If during the implementation of the corrective measure other impacts are observed, either visually or by elevated PID readings, the confirmatory samples adjacent to those areas will be analyzed for an expanded set of parameters including TCL VOCs, TCL SVOCs, and TAL Metals. Expanded parameters will include the following laboratory methods:

- VOCs – EPA Method 8260
- SVOCs – EPA Method 8270
- Metals – EPA Method 6010
- Total cyanide - EPA Method 9010/9014
- Mercury - EPA Method 7471

The samples will be analyzed at an ELAP lab certified laboratory and reporting limits will be less than the SCOs for each chemical tested. These samples will require quality control samples, including field duplicate and matrix/matrix-spike duplicates at a frequency of 1 per 20 samples. Chain of custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Level B documentation will be provided by the laboratory and a Data Usability Summary Report will be prepared for all samples.

If visual observation or the results of confirmatory sampling indicate impacted soil is present outside NFG's property line, a supplemental work plan will be prepared to investigate these areas to determine the extent of impacted soils.

4.4 Additional Perimeter Fencing

Following the Site restoration activities, additional new chain-link fence will be installed along the western and southern property lines in the area of concern as shown on Figure 2. The new fence will be installed to maintain Site control, meet the engineering control requirements, and prevent access to

NFG property in accordance with the *Final Engineering Report – Vol II, Operations and Maintenance Plan* (RETEC, 2002). The new fence will be six-feet high and will be constructed of chain-link fabric. As shown on Figure 2, the alignment of this fence will be connected to the existing (new) fence at the northern limit of the area of concern and extend southward along the western property boundary toward the southern property boundary, pass the National Grid electrical tower, and then turn East and connect to the existing (new) fence to the east of the National Grid electrical tower. Installation of the additional perimeter fence will be performed in the same manner as the recently installed fence, with visual and PID screening performed on all drilled post holes. Any materials exhibiting impacts from visual or PID screening will be segregated, characterized, and disposed of properly. Fence installed along the southern boundary will not be set in concrete due to possible removal and replacement of the storm sewer structure.

4.5 Site Completion/Restoration

Final site restoration will be implemented following construction of the drainage ditch and installation of the additional security fencing along the western property line. Due to space limitations and steep slopes between the two fences, the final Site restoration will consist of geotextile fabric and landscaping stone. In addition, landscape shrubbery will be planted along the slope to maintain slope stability and create a visual barrier.

4.6 Waste Management

During the fence installation in July 2013, the soils encountered in the fence post holes from the southern portion of the west fence line and the western portion of the southern fence line were segregated and placed in a stockpile on site. The origin of these soils is coincident with the area of concern for the corrective measures. These sample results will be used to characterize the soils being removed from the area of concern for waste disposal offsite. Any soils encountered that exhibit purifier waste characteristics will be segregated and disposed of separately. The previous analytical data was submitted to the NYSDEC via email on July 30, 2013. Additional samples may be collected for waste characterization if required by the waste management disposal facility.

No material shall be transported off-site except to a permitted disposal or treatment facility, for which waste characterization will be necessary. All transport of materials will be performed by NFG approved licensed haulers and in accordance with appropriate local, State, and Federal regulations, including New York Codes, Rules and Regulations (NYCRR) in 6 NYCRR Part 364. Approved haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. No material containing free liquids will be transported. Trucks will be prohibited from stopping and idling in the neighborhood outside the project site. Egress points for truck and equipment transport from the site will be kept free from soil and other material during transport.

All soil waste excavated and removed from the Site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6 NYCRR Part 360) and Federal regulations. Any approved materials transported off-site shall only be transported to a permitted disposal or treatment facility identified by NFG. Required characterization samples for the waste will be collected and analyzed as part of additional site characterization as described previously.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2.

5.0 Health and Safety

There are physical hazards which may be present at the Site associated with existing conditions and with investigation activities. Potential physical hazards include the following:

- Traffic – Requires care when entering and leaving the Site.
- Overhead and underground utilities – high voltage overhead and buried power lines exist along the southern boundary. Any excavation and fence installation work performed in this area has a potential for encountering these utilities.
- Mechanical equipment including trucks and excavators.
- Slips, trips, and falls – General site hazards including uneven terrain, open excavations, and work related debris and equipment present potential tripping hazards.
- Exposure to hazardous wildlife and plants.

As indicated previously, post-remedial data collection activities have been performed at the Site annually since 2002. Data from those investigations indicate that MGP residuals are present in soils and groundwater at the Site.

All construction and oversight personnel will be bound by the provisions of the Health and Safety Plan (HASP) and NFG's contractor H&S requirements. All field staff are required to participate in a preliminary project safety meeting to familiarize them with the anticipated hazards and respective onsite controls. The discussion will cover the entire HASP subject matter, putting emphasis on critical elements of the plan; such as the emergency response procedures, personal protective equipment, site control strategies, and monitoring requirements. In addition, daily tailgate safety meetings will be held to discuss the anticipated scope of work, required controls, new hazards and controls, incident reporting, review the results of inspections, any lessons learned or concerns from the previous day. Attendance rosters from all safety meetings will be signed by all present and incorporated into the project records. Health and Safety protocols for the Site are presented in the Site Specific HASP, which is included in Attachment A.

6.0 Community Air Monitoring Plan

Air monitoring will be performed to verify that contaminants from the site do not impact nearby residents or visitors during site characterization or construction in accordance with the New York State Department of Health's (NYSDOH's) Generic Community Air Monitoring Plan (Generic CAMP). Temporary monitoring stations will be installed to provide continuous real-time monitoring at the upwind and downwind work perimeters. Monitoring will be performed for VOCs and particulates with

a diameter of 10 micrometers or less (PM-10). An additional monitoring station will be placed between the work area and the nearest residence.

VOCs will be monitored at the downwind perimeter of the immediate work area on a continuous basis using a photoionization detector (PID). As a minimum, upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The equipment will be capable of calculating 15-minute running average concentrations,

Response levels and mitigation requirements for total VOC concentrations include the following:

- Greater than 1.0 parts per million (ppm) above background as a 15 minute average – Place a CAMP monitoring station half way between the property line and the nearest residence or potential exposure location. If the average concentration of VOCs is greater than 1.0 ppm as a 15 minute average, stop work and cover all potential sources of VOCs. Before work restarts, implement NYSDOH Special Requirements CAMP requirements. These requirements are provided in Attachment B.

- Greater than 5.0 parts per million (ppm) above background as a 15-minute average – Stop work activities until the total VOC concentration is reduced below 5.0 ppm.

- Between 5.0 and 25.0 ppm - Halt work activities and take corrective actions to abate emissions.

- Greater than 25.0 ppm – Stop all work activities.

Particulate monitoring will be performed using real-time monitoring equipment capable of measuring PM-10 particulate matter and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate exceedance of the action level.

Response levels and mitigation requirements for PM-10 include the following:

- Greater than 100 micrograms per cubic meter ($\mu g/m^3$) above background as a 15-minute average or if visible dust is observed – Implement dust suppression techniques.
- If implementation of dust suppression techniques does not reduce PM-10 concentrations below 150 $\mu g/m^3$ above background, work must be stopped and activities re-evaluated. Place a CAMP monitoring station half way between the property line and the nearest residence or potential exposure. If the average concentration of particulates is greater than 150 ug/m^3 as a 15 minute average, implement NYSDOH Special Requirements CAMP requirements. These requirements are provided in Attachment B.
- If visible dust is generated, work will stop until effective mitigation has been implemented.

An Odor Control Plan will also be implemented as part of the CAMP. As part of the plan, if unpleasant odors are noted at any time while land disturbing activities are being performed, the following procedures will be followed:

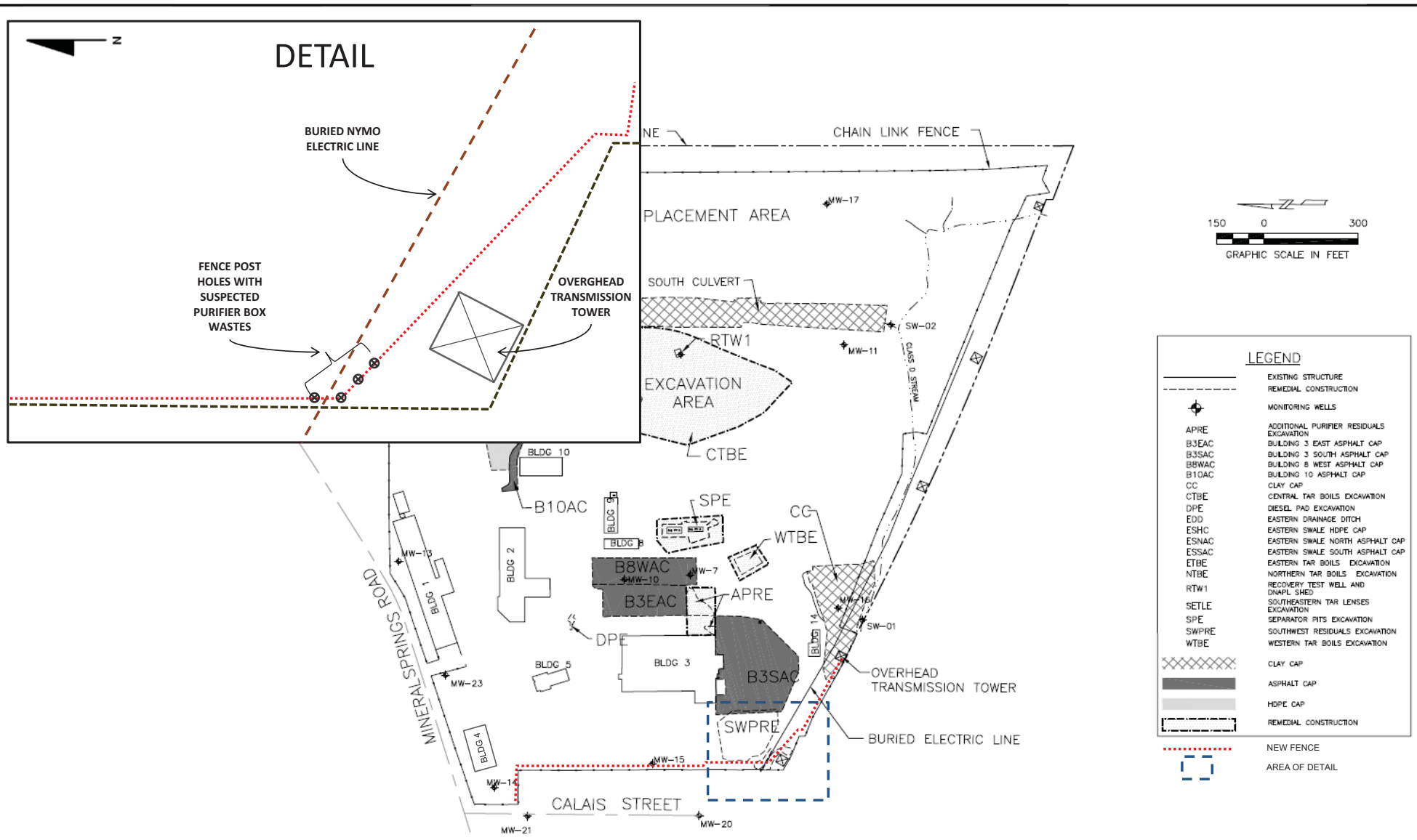
- Water will be used for dust reduction as noted above.

- Soil from fence post cuttings or swale excavation which are a source of odors will be covered, placed in drums, or removed from the area.
- In addition, if excessive nuisance odors are noted at the property boundary or if there are complaints from residents, the area which is acting as the source of the odors will be covered and work will be moved to another location until the wind direction changes.
- If these measures don't address the issue, work will be stopped and all disturbed earth covered or moved until additional measures can be provided.

7.0 Schedule

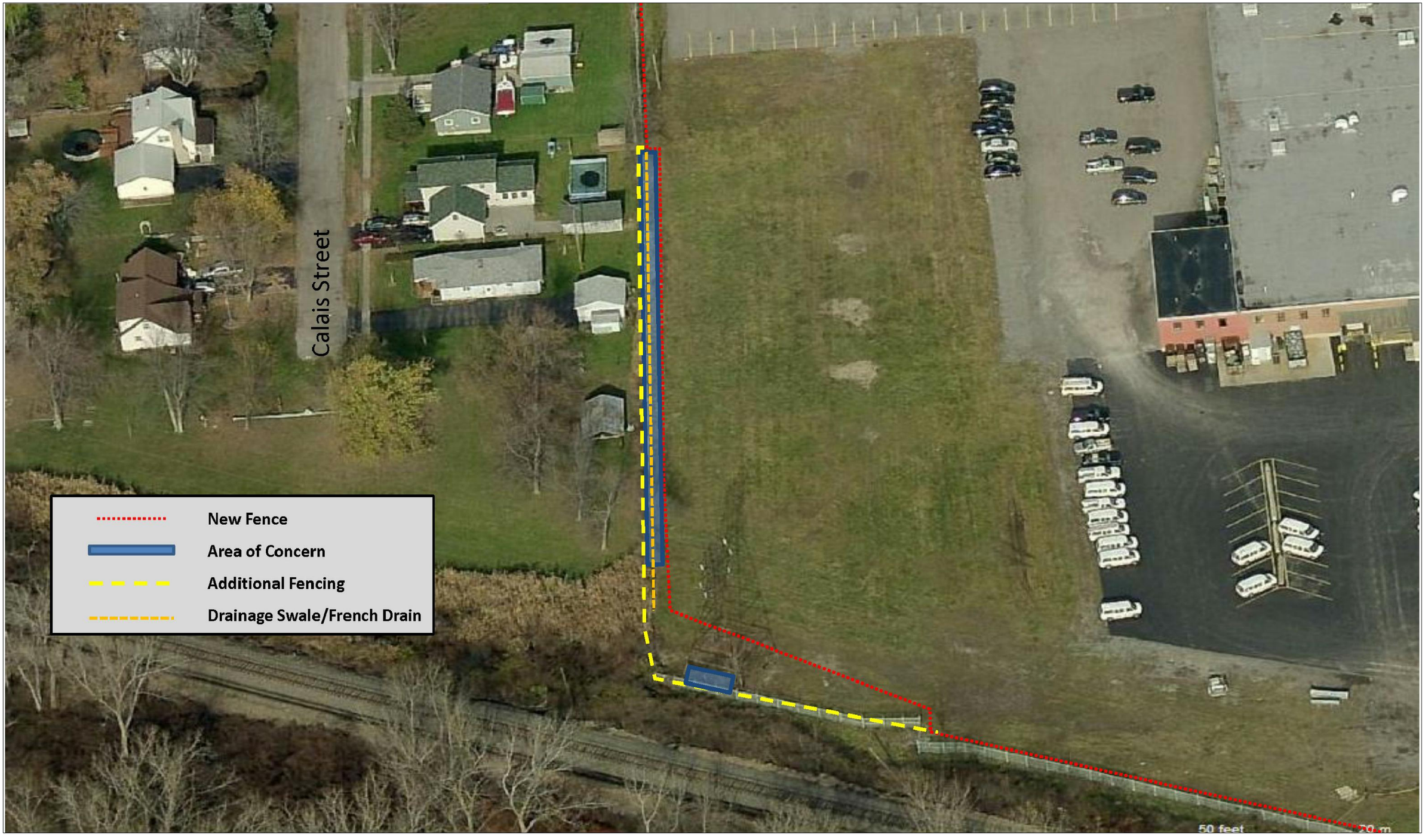
A schedule will be developed following approval of this CMWP. A copy of the schedule will be sent to the NYSDEC.

Figures



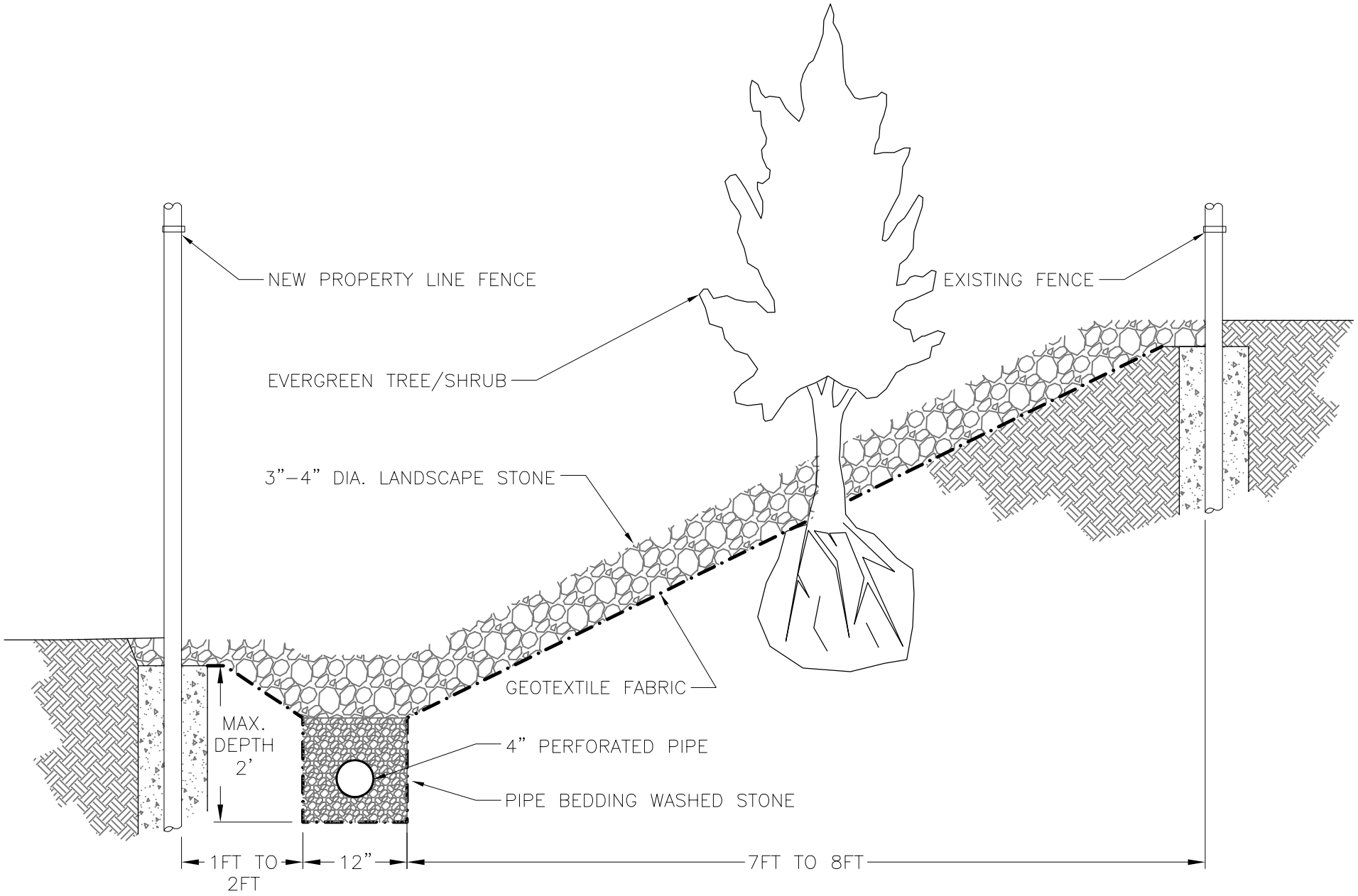
AECOM

MINERAL SPRINGS ROAD FACILITY NATIONAL FUEL GAS 60250836.300	Fence Post Locations
DATE: 03/26/13 DRWN: BcV	FIGURE 1



AECOM

MINERAL SPRINGS ROAD FACILITY NATIONAL FUEL GAS 60250836.300			**PROPOSED CORRECTIVE MEASURE**	
DATE: 08/20/2013	DRWN: BcV			**FIGURE 2**



AECOM

NOT TO SCALE

NATIONAL FUELS GAS MINERAL SPRINGS ROAD FACILITY 6025836.200			**TYPICAL DRAIN DETAIL**
DATE: 09/20/13	DRWN: BcV		**FIGURE: 3**

Attachment A

Health and Safety Plan

Health and Safety Plan

Ongoing Activities
Former Mineral Springs Manufactured Gas Plant Site
West Seneca, NY

9/20/2013

HEALTH AND SAFETY PLAN APPROVAL

This Health and Safety Plan (HASP) was prepared for _____ and their subcontractors performing a specific, limited scope of work. It was prepared based on the best available information regarding the physical and chemical hazards known or suspected to be present on the project site. While it is not possible to discover, evaluate, and protect in advance against all possible hazards, which may be encountered during the completion of this project, adherence to the requirements of the HASP will significantly reduce the potential for occupational injury.

By signing below, I acknowledge that I have reviewed and hereby approve the HASP for this project. This HASP has been written for the exclusive use of _____ and their subcontractors. The plan is written for specified site conditions, dates, and personnel, and must be amended if these conditions change.

Approved by: _____

Approved by: _____

Table of Contents

ATTACHMENTS

Emergency Coordinators / Key Personnel			
Name	**Title**	**Telephone Number**	**Cellular Phone**
TBD	**Project Manager**	**TBD**	**TBD**
Brad Walker	**National Fuel Gas Project Manager**	**(716) 667-5559**	**(716) 517-5146**
TBD	**Project Engineer**	**TBD**	**TBD**
Paul White	**National Fuel Gas Property Manager**	**(716) 827-2345**	**(716) 570-2757**
TBD	**Corporate**		
TBD	**Site Health & Safety Manager**	**TBD**	**TBD**

Organization / Agency	
Name	**Telephone Number**
Police Department	911
Fire Department	911
State Police	911
Ambulance Service ***(EMT will determine appropriate hospital for treatment)***	911
Poison Control Center	800-222-1222
National Response Center	800-424-8802
Dig Safe NY	811

1.0 Introduction

1.1 HASP Purpose

This Health and Safety Plan (HASP) template has been prepared for any post-remedial action work at the former Mineral Springs manufactured gas plant (MGP) Site located in West Seneca, New York (the Site) to be used to prepare a site-specific HASP by any future party performing work at the Site. This template provides guidance for potential hazards that may be encountered during field activities that may be required to complete any post-remedial activities. The primary post remedial field activities may include, but are not limited to, the following:

- Future intrusive construction work
- Inspection and maintenance of the soil cap systems at various locations on the former site
- Operation, maintenance and monitoring of the NAPL collection system
- Groundwater monitoring.

During intrusive work and other field activities, field staff may be exposed to hazards associated with chemicals of concern on and off the Site. As a result, field personnel may be required to have specialized training (i.e. as per 29 CFR 1910.120) or wear personal protective equipment (PPE) suitable for the level of contaminates present. Air monitoring may be required to evaluate contamination levels, ambient air conditions, and to determine if additional PPE is necessary.

Field staff may also be exposed to other hazards that are encountered during field activities including slips, trips, falls, automobiles, traffic, heavy equipment, drill rigs, and winches. Depending upon the time of season, field staff may be exposed to biological hazards, for example insect bites, stings, ticks, and snakes. Meteorological hazards such as lightning, wind, rain, and ultraviolet radiation may also be present.

This HASP template outlines safety and health requirements and guidelines for project work. When implemented, these requirements will help protect site personnel, visitors, the public and environment from exposure to potential safety and health hazards.

This HASP must be updated as conditions change or situations change, usually by addenda to the plan. All field personnel must understand and implement the HASP and any addenda.

1.2 Compliance

All workers working for AECOM or National Fuel Gas on this project must comply with Occupational Safety and Health Administration (OSHA) Title 29 of the Code of Federal Regulations (29 CFR 1910), Safety and Health Regulations for General Industry and applicable sections of 29 CFR 1926 Safety and Health Regulations for the Construction Industry. Under OSHA, each employer is required to develop and implement a written site-specific HASP that addresses the safety and health hazards of each phase of site operation and includes the requirements and procedures for worker protection. The minimum elements for this plan are contained in 29 CFR 1910.120(b)(4)(ii).

Contractor/subcontractor employees and third party personnel performing work that potentially exposes them to the chemical and physical hazards at the site shall comply with the OSHA safety requirements, and the health and safety procedures required by their employers.

Subcontractors, visitors, and contract employees are required to be present at a verbal full HASP review given by AECOM Site Safety and Health Manager. Workers coming on to the project after the work has commenced in the field will also be given a documented full HASP review before starting work. A copy of the Health and Safety Plan Acceptance Form is provided in Attachment A.

1.3 Health and Safety Expectations

Commitment to safety, health, and environmental excellence requires that all work proceed only after it is safe and environmentally sound to do so. The responsibility for ensuring that this takes place rests with every worker present at this project. Effectively meeting these responsibilities depends upon open communication between individuals and their supervisors prior to work beginning, and – in certain cases – after safety, health and/or environmental issues are identified. Completing a Job Safety Analysis (JSA) to aid in planning safe work performance will be an integral part of meeting safety, health and environment (SHE) expectations. A copy of the Job Safety Analysis Form is provided in Attachment B.

The ultimate goal of this project is zero preventable incidents (OSHA recordables, lost workdays, property damage, etc.). To achieve this goal, everyone on the project is responsible for eliminating or correcting risky behavior or unsafe conditions. All personnel and subcontractors have the authority to STOP WORK if they see a potential or actual hazard that may threaten the safety of people or the environment. If unsafe conditions are observed, corrective action shall be taken and/or a supervisor shall be immediately notified. If someone is observed performing an unsafe act, that person shall be informed that their behavior is putting them or others in danger.

1.4 Management of Change/Modification of the HASP

1.4.1 Management of Change

This document discusses the physical, chemical, and biological hazards associated with the proposed activities. However, unanticipated site-specific conditions or situations might occur during the implementation of this project. Also, contractors may elect to perform certain tasks in a manner that is different from what was originally intended due to a change in field conditions. As such, this HASP must be considered a working document that is subject to change to meet the needs of this dynamic project.

1.4.2 HASP Modification

Should significant information become available regarding potential on-site hazards, it will be necessary to modify this HASP. Any significant modifications must be incorporated into the written document as addenda and the modified section of the HASP must be reissued. Sign-off forms will accompany each addendum and must be signed by all personnel covered by the addendum. The HASP addenda shall be distributed during the daily safety meeting so that they can be reviewed and discussed.

1.5 Job Safety Analysis (JSA)

Prior to beginning work, detailed site specific hazards and controls will be provided in the JSA for each phase of the operation. Each phase of the work is defined in the Work Plan. The JSAs will provide information on how the requirements of major sections of HASP will be met. Particular attention shall be paid to excavations, PPE, fire prevention, machinery and mechanized equipment, electrical safety, public safety requirements, chemical and physical agent, and biological occupational exposure prevention requirements.

The JSAs will be considered a “living document” with revisions incorporated based on actual work activities being performed, new hazards encountered during the job, or as conditions change. The contents of the JSAs will be communicated to affected personnel before work begins and shall be periodically reviewed with affected personnel thereafter.

1.6 Multiple Employer Projects

Under OSHA, each employer is required to provide a safe and healthful working environment for employees. When several employers are working simultaneously on the project, the activities of one employer could expose personnel of another company to a hazard.

Where an employer creates unsafe conditions, the exposing employer shall be responsible for exercising reasonable diligence to discover the condition, and for taking steps to protect their personnel. When the exposing employer has authority to correct the hazard, it shall do so. Where the exposing employer lacks the authority to correct the hazard, the employer shall ask the creating and/or controlling employer to correct the hazard; inform its personnel of the hazard; and take reasonable alternative protective measures. In extreme circumstances (e.g., imminent danger situations), the exposing employer shall remove their personnel from the area to avoid the hazard.

1.7 Visitors

Authorized visitors (e.g., client representatives, regulators, etc.) requiring entry to any work location on the site will be briefed by the PM 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 HASP specifies the minimum acceptable qualifications, training and PPE which are required for entry to any controlled work area; visitors must comply with these requirements. Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas.

2.0 Project Description

This section provides a description of the Mineral Springs site and surrounding properties, and a summary of information regarding site ownership and operational history of the former MGP..

2.1 Site Description

The Mineral Springs Site lies in a flat, mixed industrial and residential area of West Seneca (and Buffalo), New York. The Mineral Springs Site is an active NFG service center. Figure 1 shows the facility layout.

The stratigraphy of the site consists of 4- to 8-feet of soil and fill, approximately 10-feet of a nearly continuous upper confining clay layer (UCL), 10- to 15-feet of groundwater bearing silt, sand, and gravel, a lower confining clay layer (LCL), and bedrock. Overburden groundwater is typically encountered 5- to 12-feet below ground surface and fluctuates seasonally approximately 2 feet. Overburden groundwater flow is generally to the northwest towards Mineral Springs Road, Calais Street, and the Buffalo River. Average overburden groundwater velocity across the site is calculated to be approximately 0.06 feet per day.

2.2 History of Operations

The former Mineral Springs MGP was built in the early 1920's and was operated until the 1960's. Coal and oil gasification wastes, particularly coal tar hydrocarbons and blue-stained purifier residuals, were generated during operation of the plant. Investigations were performed between 1990 and 1998 to evaluate environmental conditions at the site. Those investigations identified impacts to soil and groundwater by MGP residues, including organic constituents, dense non-aqueous phase liquids (DNAPL), and cyanide. Remedial activities including excavation, capping, DNAPL recovery, and institutional controls have been performed since 1997 to address these impacts.

2.3 Site Remedial Action

An interim remedial measure (IRM) was conducted at the Mineral Springs Site in December 1997. During the IRM, 407 tons of purifier residuals were removed from the southwest corner of the site. On August 4, 1998 NFG submitted a Voluntary Cleanup Agreement (VCA) program application. VCA number B9-0538-98-08 was signed by NFG on June 2, 1999 and by NYSDEC on November 7, 1999. A Remedial Design Work Plan was subsequently developed by NFG and NYSDEC. From May 2000 to June 2001, the Remedial Design Work Plan was implemented and the following remedial tasks were completed:

- Excavation and offsite disposal of 32,200 tons of contaminated soil, rubble, and purifier waste.
- Construction of engineering controls including 39,369 square feet of clay cap, 76,144 square feet of geomembrane cap, 130,890 square feet of asphalt cap over areas where purifier waste was located
- Capping of hydrocarbon seeps within the Eastern Drainage Ditch (EDD), including construction of 640 linear feet of geosynthetic cap and 750 linear feet of clay cap.
- Installation of additional chain link security fence around the site perimeter.
- Implementation of site use and deed restrictions.
- Collection, treatment, and disposal of 207,000 gallons of contaminated groundwater.

During the annual site inspection in April 2007, NFG identified a faint blue stain in surface gravel near Building 8. In July 2007, a soil investigation in the area identified a subsurface lens of bluish stained soils. Based on the results of the investigation, an IRM Work Plan was prepared describing an IRM to address the stained soil. The IRM Work Plan was submitted to NYSDEC in November 2008. The scope of the IRM included installation of a 24,000 square foot asphalt cap immediately to the east of the existing Building 3 East Asphalt Cap (B3EAC). Work to install the new cap took place in June and July 2008. The new cap is designated as the Building 8 West Asphalt Cap (B8WAC), as shown on Figure 1.

2.4 HASP Scope of Work

Activities included in the scope of this HASP include operations, maintenance and monitoring of engineering and institutional controls which are part of potential remedial actions at the site during the implementation of the O&M activities. Specific activities include:

- Operation, maintenance, and monitoring of the NAPL collection system
- Groundwater monitoring
- Inspections of engineering controls including soil, HDPE, asphalt, and clay caps and other site features.

These activities are described in the Operation and Maintenance (O&M) Plan for the remedial action. Additional activities that may be required during implementation of the O&M Plan and normal site operations include the following:

- Excavation of soil and other intrusive actions in portions of the site where MGP impacts may remain.
- Dewatering of excavations
- Management of soil and groundwater generated during intrusive activities.

2.5 Waste Management

Waste which may be generated during the work described includes the following:

- Used personal protective equipment (PPE)
- Groundwater from well purging during monitoring and excavation dewatering
- Soil generated from excavations
- Trash and construction debris.

Used PPE which may be contaminated and groundwater will be stored in drums, labeled, and stored onsite until approval from a disposal or treatment facility is obtained. These wastes will be transported off-site to permitted National Fuel Gas approved facilities. Trash and other un-impacted material will be disposed of in an appropriate receptacle.

3.0 Organization/Responsibility

3.1 Introduction

The implementation of health and safety at this project location will be the shared responsibility of the Project Manager (PM), the Corporate Safety, Health & Environment Manager (CSHEM), the Project SSO, and other personnel and contractors implementing the proposed scope of work.

3.2 Project Manager

The PM is the individual who has the primary responsibility for ensuring the overall health and safety of this project. The specific safety responsibilities for the PM are listed in Section 4.1.2 of SH&E 301, *Project SH&E Planning Documentation*. The PM will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations. As such, the PM is responsible for ensuring that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Allocate the resources necessary for the successful implementation of all necessary safety procedures;
- Ensure that subcontractor(s) have received a documented verbal full review of the HASP, as well as documented quarterly verbal HASP reviews;
- Communicate health and safety expectations to field staff and subcontractors;
- Select subcontractors based on their safety and health performance metrics;
- Support the decisions made by the field team;
- Maintain regular communications with the field team and, if necessary, the CSHEM; and
- Conduct random project audits. (Management Site Visits).

3.3 Corporate Safety, Health & Environment Manager

The CSHEM is the individual responsible for the preparation, interpretation and modification of this HASP. Modifications to this HASP which might result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CSHEM. Specific duties of the CSHEM include:

- Write, approve and amend the HASP for this project;
- Review for acceptance subcontractors HASP and JSAs for the project;
- Advise the PM and field team on matters relating to health and safety on this site;
- Recommend appropriate PPE and respiratory equipment to protect personnel from potential site hazards;
- Facilitate Incident investigations;
- Maintain regular contact with the PM and field team to evaluate site conditions and new information which might require modifications to the HASP; and
- Conduct random project audits.

3.4 Site Supervisor

The site supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans. The PM may act as the site supervisor while on site.

3.4.1 Responsibilities

The site supervisor is responsible to:

- Discuss deviations from the work plan with the SSO and PM;
- Discuss safety issues with the PM, SSO, and field personnel;
- Assist the SSO with the development and implementation of corrective actions for site safety deficiencies;
- Assist the SSO with the implementation of this HASP and ensuring compliance; and
- Assist the SSO with inspections of the site for compliance with this HASP and applicable SOPs.

3.5 Site Safety Officer

All field personnel are responsible for implementing the safety requirements specified in this HASP. However, one person at the site will serve as the SSO. The SSO will be appointed by the PM. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct all situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. The SSO must be considered acceptable by National Fuel Gas before assuming those duties. This includes any back-up SSOs, or replacement SSOs.

3.5.1 Responsibilities

Some of the SSO's specific responsibilities include:

- Ensure that all personnel to whom this HASP applies, including all subcontractors, have been given a documented verbal full HASP review by , and submitted a completed copy of the HASP review and acceptance form (Attachment A);
- Ensure that all personnel to whom this HASP applies have attended a documented pre-job/shift briefing and any subsequent safety meetings that are conducted during the implementation of the program;
- Update the site-specific HASP to reflect changes in site conditions or the scope of work. HASP updates must be reviewed and approved by the Safety Professional, as well as accepted by National Fuel Gas before the modifications are to be implemented;
- Be aware of changes in Safety Policy;
- Monitor the lost time incidence rate for this project including all OSHA recordable injuries/illness as well as lost time associated with all OSHA-recordable incidents and work toward improving it;
- Inspect the site for compliance with this HASP and the SOPs using the appropriate audit inspection checklist provided by an Safety Professional;

- Work with the site supervisor and PM to develop and implement corrective action plans to correct deficiencies discovered during site inspections. Deficiencies will be discussed with project management to determine appropriate corrective action(s);
- Provide a means for employees to communicate safety issues to management in a discreet manner (i.e., suggestion box, etc.);
- Procure all appropriate air and noise monitoring instrumentation required and perform air monitoring for and subcontractor activities;
- Procure and distribute the PPE and safety equipment needed for this project for employees;
- Verify that all PPE and health and safety equipment used by is in good working order;
- Verify that subcontractors have a written HASP, workers are trained in accordance with training requirements of this HASP and that subcontractors are prepared with the PPE, respiratory protection and safety equipment required for this project. The provisions of the subcontractor's HASP have been incorporated into this HASP and the subcontractors will be responsible for following it.
- Prepare an initial JSA during the initial mobilization and revising the JSA if conditions or tasks change and communicating with all workers the results of the JSA. See Attachment B for a JSA form. The JSA will be reviewed daily by all workers and updated as needed;
- Notify the PM of all noncompliance situations and stop work in the event that an immediate danger situation is perceived;
- Determine emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation;
- Ensure that all site personnel and visitors have received the proper training and medical clearance prior to entering the site;
- Establish any necessary controlled work areas (as designated in this HASP or other safety documentation);
- Conduct accident/incident investigations and prepare accident/incident investigation reports as well as preparation of preventative action plans;
- Conduct the pre-job/shift briefing for employees and subcontractors prior to beginning of work and subsequent tailgate safety meetings and maintain attendance logs and records;
- Discuss potential health and safety hazards with the Site Supervisor, the Safety Professional, and the PM;
- Initiate emergency response procedures in accordance with Section 14.0 of this HASP; and
- Select an alternate SSO by name and inform him/her of their duties, in the event that the SSO must leave or is absent from the site. The alternate SSO must be approved by the PM and National Fuel Gas.

3.6 Field Personnel

All field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner.

Some of the specific responsibilities of the field personnel associated with this project are discussed below.

- Understand and abide by the policies and procedures specified in the HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete;
- Provide feedback to health and safety management relating to omissions and modifications in the HASP or other safety policies;
- Notify the SSO, verbally and in writing, of unsafe conditions and acts;
- The right to refuse to work and/or stop work authority when the employee feels that the work is unsafe (including subcontractors or team contractors), or where specified safety precautions are not adequate or fully understood;
- The right to refuse to work on any site or operation where the safety procedures specified in this HASP or other safety policies are not being followed; and
- The right to contact the SSO or the Safety Professional at any time to discuss potential concerns.

4.0 Chemical Hazard Assessment and Control

4.1 Chemical Contaminants of Concern

The predominant contaminants of concern (COC) associated with this project are constituents of the manufacturing gas process which include but not limited to: Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), including Poly-Aromatic Hydrocarbons (PAHs) and purifying waste containing cyanide and metals.

Intrusive activities involving drilling/excavation/handling of contaminated materials or contact with site groundwater have the potential to cause significant exposures to site personnel through inhalation, skin contact, and ingestion of the contaminants found in the soils and water. Exposure can exceed permissible exposure limits for any or all contaminants and have the potential to produce significant harm to individuals who are not adequately protected (use of proper PPE) and do not perform proper decontamination when leaving Exclusion Zones.

4.2 Volatile Organic Compounds

Volatile Organic Compounds refer to a group of volatile compounds or mixtures that are relatively stable chemically and that exists in the liquid state at temperatures of approximately 32° to 82°F. Inhalation and skin absorption are the primary routes of exposure. Organic compounds are metabolized or they accumulate in the lipid-rich tissues such as the liver, fat cells, or the nervous system. At this site, these compounds include benzene, ethyl benzene, toluene, and xylenes. See the table in Section 4.7 for compound specific information and monitoring action levels.

4.3 Semi-Volatile Organic Compounds

Semivolatile Organic Compounds (SVOCs) are less volatile chemicals that tend to persist in the environment. Typical coal gasification byproduct (coal tar) constituents are referred to as polynuclear aromatic hydrocarbons (PAH) compounds. PAH compounds are a family of multiple ring aromatic compounds commonly found in fossil fuels and are formed from the incomplete combustion of organic materials. Repeated contact with PAH compounds may cause photosensitization of the skin, producing skin burns after subsequent exposure to ultra-violet light. Certain PAHs as a group are considered potential human carcinogens (CaPAH). OSHA regulates PAHs as coal tar pitch volatiles (CTPV) and has established a PEL for CTPV of 0.2 mg/m^3, as an 8-hour TWA. See the table in Section 4.7 for compound specific information and monitoring action levels.

4.4 Metals

4.4.1 Cyanide

Cyanide wastes at MGP sites exist mostly as stable iron cyanide complexes, such as ferric ferrocyanide, which are associated with oxide box wastes common to coal gas sites. Blue staining (Prussian Blue) in soil is the characteristic associated with the presence of oxide box wastes (ferrocyanide). Therefore, the presence of this material is very easily identified during field investigations. The cyanides associated with oxide box wastes are present in a form that is generally unavailable or complexed with metals such as iron, which makes the cyanide more stable. Thus, the reported effects of free cyanide are not applicable. OSHA has not established a PEL for ferro/ferri cyanide compounds. Similarly, the ACGIH has not recommended a TLV for these compounds.

4.5 Dust

Dust generated during excavations can be hazardous to the respiratory system and irritating to the eyes. Dust can also carry the contaminants of concern potentially exposing workers by skin contact and inhalation. The ACGIH has established an eight-hour exposure limit for dust at 3 mg/m^3. The concentrations of the chemicals of concern in the soil are low enough that inhalation of dust would not by itself be an exposure hazard. However contamination of skin and clothing can provide additional exposures. Therefore the generation and contact with dust should be minimized.

Water or other methods should be used to control dust during dusty operations; however care must be used to prevent electrical shock if electric tools are used in the same area. Water use should be limited to prevent erosion and sedimentation from the site to nearby catch basins or other drainage features. If dusts become irritating and engineering controls such as the application of water cannot be used, respirators shall be donned as discussed in Section 7.

4.6 Other Chemicals

Additionally as with any construction sites other chemical hazards are expected to be present in various forms including the following:

- Fuel and lubricants (e.g., gasoline, diesel fuel, hydraulic oil)
- Cleaning agents (e.g., detergents, hand cleaner, respirator sanitizers)
- Miscellaneous chemicals (e.g., marking paints, bulk office supplies)
- Groundwater sample preservatives

4.7 Summary of Hazardous Properties of Potential Contaminants

Chemical Name	Characteristics	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]	IP[10]
Benzene	Clear, colorless liquid with an aromatic odor, low vapor pressure, high flammability, vapors heavier than air, evaporates very quickly, inhalation is the most likely route of exposure. Can cause drowsiness. Benzene is considered by the EPA to be a human carcinogen.	1	0.5	75	2.8	0.88	<1	12	1.2	7.8	9.24
Toluene	Colorless, flammable liquid, a mild (aromatic) odor. Enters the body when inhaled, ingested, or absorbed through the skin contact, does not remain in the body due to its breakdown and removal. Can cause nausea and dizziness, irritation of the mucous membranes of the upper respiratory tract, nose and mouth.	200	50	21	4	0.87	<1	40	1.1	7.1	8.82

Chemical Name	Characteristics	PEL[1]	TLV[2]	VP[3]	VD[4]	SG[5]	SOL[6]	FP[7]	LEL[8]	UEL[9]	IP[10]
Ethyl Benzene	Colorless, flammable liquid, enters the body when inhaled, ingested, or absorbed through the skin contact.	100	100	7	4	0.87	<1	55	0.8	6.7	8.76
Xylene	A colorless, flammable liquid, a mild (aromatic) odor. Enters the body when inhaled, ingested, or absorbed through the skin contact, does not remain in the body due to its breakdown and removal. Can cause nausea and dizziness.	100	100	9	4	0.86	<1	81	1.1	7.0	8.56
Naphthalene	Characteristic moth-ball like odor. May cause nausea, vomiting, abdominal pain and irritation of the bladder. Prolonged overexposure may result in renal shut down. May cause rashes and allergy.	10	10	1	4.4	1.2	<1	189	0.9	5.9	8.12
Phenol	A combustible liquid, corrosive, hygroscopic, and light sensitive material. Can be harmful if inhaled, swallowed,	5	5	0.4	3.5	1.06	9	175	1.8	8.6	8.50
Hydrogen Cyanide	Exposure to small amounts of cyanide can be deadly regardless of the route of exposure. The severity of the harmful effects depends in part on the form of cyanide, such as hydrogen cyanide gas or cyanide salts. Exposure to high levels of cyanide for a short time harms the brain and heart and can even cause coma and death.	10	C 4.7	0	1.7	0.69	100	0	NA	NA	NA
Lead dust	Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. It is commonly found in soil near roadways, older houses, old orchards, mining areas, industrial sites, and hazardous waste sites.	0.05 mg/m^3		0					NA	NA	NA

1 Permissible Exposure Limit in ppm
2 Threshold Limit Value in ppm
3 Vapor Pressure in mm Hg
4 Vapor Density (air = 1)
5 Specific Gravity (water = 1)
6 Solubility in Water in %
7 Flash Point in °F
8 Lower Explosive Limit in % by volume
9 Upper Explosive Limit in % by volume
10 IP in eV
NA = Not Applicable
? = Not known
C = Ceiling limit not to be exceeded

4.8 Chemical Exposure and Control

4.8.1 Chemical Exposure Potential

Activities which could potentially lead to chemical exposures include the following:

- Groundwater monitoring

- Clearing and grading
- Fence installation
- Soil excavation
- Waste management

A route of potential exposure to the contaminant of concern is via direct dermal contact with impacted soils or groundwater and inhalation of vapors or aerosols. Exposure to the contaminant of concern can occur via ingestion (hand-to-mouth transfer). The decontamination procedures described in Section 11.0 address personal hygiene issues that will limit the potential for contaminant ingestion.

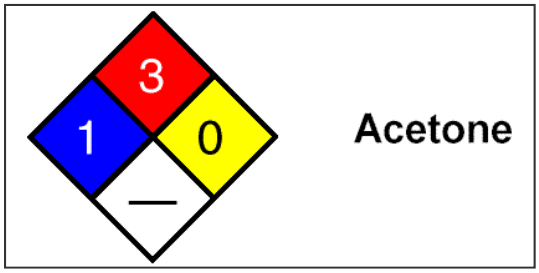
4.8.2 Chemical Hazard Control

The chemical hazards associated with these activities can be controlled in several ways, including:

- Maintain an upwind position;
- Use of personal protective equipment;
- Avoid direct contact with contaminated media;
- Follow decontamination procedures;
- Wash hands prior to eating or using tobacco products.

4.9 Hazard Substances Brought On Site

A material safety data sheet (MSDS) must be available for each hazardous substance that subcontractors bring on the property. This includes solutions/chemicals that will be used to decontaminate sampling equipment and gases needed to calibrate air monitoring equipment.



In addition, all containers of hazardous materials must be labeled in accordance with OSHA's Hazard Communication Standard. Either the original manufacturer's label or an NFPA 704M label specific for the material (as shown at the right) is considered to be an acceptable label.

5.0 Biological/ Environmental Hazards and Controls

During the course of field work employees are at risk of being exposed to poisonous plants, insects, spiders and snakes. The two most prevalent biological hazards are poison ivy and ticks. Site activities will take place in an urban area on a grassed lawn. For that reason, exposure to poisonous plants is unlikely. There are potential exposures to some animals including dogs and rats associated with trash receptacles and insects such as ticks, bees, and spiders.

5.1 Poison Ivy

Poison ivy is a common cause of a skin irritation called contact dermatitis that may result in a red, itchy rash consisting of small bumps, blisters or swelling. This native perennial grows throughout Northeast, in woods, fields, and sometimes in the garden. It grows in sun or shade, and in wet or dry places. Its growth habit depends on where it is growing, resulting in a trailing ground cover, free-standing shrub, or a vine supported by trees, shrubbery and fences. All parts of the poison ivy plant contain, urushiol, which causes the allergic reaction. Most poisoning occur during the growing season when the presence of lush foliage increases the chance of contact, but the dormant stems and roots of the vine can cause winter poisoning as well.

The best way to protect oneself against poison ivy is to avoid poison ivy. The best defense against contracting poison ivy is to recognize the plants. “Leaves of three, let it be” refers to the groupings of three leaflets connected to a common stem that characterize most of these plants. However, if you cannot avoid poison ivy, follow these precautions to help prevent contact:

- Wear protective clothing such as long-sleeved shirts, long trousers, boots or sturdy shoes with socks and gloves;
- Use a barrier cream such as CoreTex IvyX™ Pre-Contact solution;
- If contact with poison ivy has been made or is suspected, follow these guidelines:
- As soon as possible (within 5–10 minutes of contact), wash all exposed skin with strong soap (i.e. Dawn) and water to remove the oil. If this is not possible, rinse thoroughly with water;
- Use a post-contact skin cleanser such as Tenu® skin cleanser or CoreTex IvyX™ cleanser towelettes.
- Put on gloves to remove clothes and shoes, and wash clothing in hot water and detergent to remove any plant oil that may be on them.
- If a severe allergic reaction develops seek medical attention.

5.2 Ticks

Ticks transmit bacteria that cause illnesses such as Lyme disease or Rocky Mountain spotted fever. Ticks wait for host from the tips of grasses and shrubs (not from trees). When brushed by a moving person, they quickly let go of the vegetation and climb onto the host. Ticks can only crawl; they cannot fly or jump. Tick season typically lasts from April through October; peak season is May through July; seasons can vary depending on climate. Ticks can be active on winter days when the ground temperatures are about 45° Fahrenheit.

The best way to protect oneself against tick borne illness is to avoid tick bites. This includes avoiding known tick- infested areas. In wooded areas or areas with tall grass and weeds, follow these precautions to help prevent tick bites and decrease the risk of disease:

- Wear protective clothing such as long-sleeved shirts, long trousers, boots or sturdy shoes and a head covering. (Ticks are easier to detect on light-colored clothing.)
- Tuck trouser cuffs in socks. Tape the area where pants and socks meet so ticks cannot crawl under clothing.
- Apply insect repellent containing 10 percent to 30 percent DEET or 5 percent to 10 percent picaridin primarily to clothes. Apply sparingly to exposed skin. Do not spray directly to the face; spray the repellent onto hands and then apply to face. Avoid sensitive areas like the eyes, mouth and nasal membranes. Be sure to wash treated skin after coming indoors.
- Use repellents containing permethrin to treat clothes (especially pants, socks and shoes) but not skin. Always follow label directions; do not misuse or overuse repellents.
- Those who wish to avoid the use of insect repellent or treated clothing should consider the use of the Original Bug Shirt® and pants, and tick/chigger garters.
- Personnel should carefully inspect themselves each day for the presence of ticks or any rashes. This is important since prompt removal of the tick can prevent disease transmission. Removal of the tick is important in that the tick should not be crushed and care must be taken so that the head is also removed. Contact the DSHEM for guidelines on removing ticks.

5.3 Wasp and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. To avoid bees and wasps:

- If you see insects flying to and from a particular place, avoid it.
- If you are going to be in an area where disturbing a nest is likely, wear long pants and a long sleeved shirt. Insect repellent applied to your skin or clothing will not deter these stinging insects.
- Wear light colored clothing.
- Remain as calm as possible if a bee or wasp lands on your skin.
- If you don't want to wait for it to leave, gently and slowly brush it away.
- It is best not to wear perfume, cologne, or other scented soaps or scented shampoos as this attracts bees and wasps.
- Never swing, strike or run rapidly away since quick movement often provokes attack and painful stings.
- Restrain from throwing rocks or spraying nests with water.
- Avoid creating loud noises and disturbance near the nest.
- When a wasp or a bee stings a person, it injects a venomous fluid under the skin. The venom causes a painful swelling that may last for several days.

- Gently scrape the area of the bite using a blunt object like a fingernail or a credit card to remove the stinger. If removed within 15 seconds of the sting, the severity of the sting is reduced.
- Try not to rub or scratch the sting site after the stinger is removed.
- Wash the sting site with soap and water.
- Apply a cold or ice pack wrapped in cloth for a few minutes.
- If you develop hives, difficulty breathing or swallowing, wheezing or similar symptoms of allergic reaction, SEEK MEDICAL ATTENTION IMMEDIATELY. People with known allergies to insect stings should NEVER work alone.
- A person with a history of severe allergic reaction to an insect sting may be advised by their physician to carry an insect sting allergy kit to counteract the allergic reaction whenever they may encounter stinging insects. Also they should consider wearing a medical ID bracelet and notify others on the field team.

5.4 Thermal Stress

5.4.1 Heat Related Illnesses

Heat-related illness (HRI) is a well-recognized hazard in the outdoor work environment. HRI includes heat fatigue, heat rash, fainting, heat cramps, heat exhaustion, and heat stroke. Excessive heat exposure is also linked to injuries from falls, equipment operation accidents and other on-the-job incidents due to fatigue, dizziness, and disorientation. Use of impermeable clothing (e.g. Tyvek®) reduces the cooling ability of the body due to evaporation reduction. This may lead to heat stress. Impermeable clothing will only be worn when absolutely necessary for control of hazardous chemicals.

Heat exhaustion: Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a form of mild shock. If not treated, the victim may suffer heat stroke. Signals of heat exhaustion include cool, moist, pale flushed or red skin; heavy sweating; headache; nausea or vomiting; dizziness; and exhaustion. Body temperature will be near normal.

Heat stroke: Also known as sunstroke, heat stroke is life-threatening. The victim's temperature control system, which produces sweating to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly. Signals include hot, red and dry skin; changes in consciousness; rapid, weak pulse; and rapid, shallow breathing. Body temperature can be very high-sometimes as high as 105 degrees.

<u>General Care for Heat Emergencies</u>

Heat cramps or heat exhaustion: Get the person to a cooler place and have him or her rest in a comfortable position. If the person is fully awake and alert, give half a glass of cool water every 15 minutes. Do not let him or her drink too quickly. Do not give liquids that contain alcohol or caffeine. Remove or loosen tight clothing and apply cool, wet cloths, such as towels or sheets. Call 911 if the person refuses water, vomits or loses consciousness.

Heat stroke: Heat stroke is a life-threatening situation! Help is needed fast. Call 911. Move the person to a cooler place. Quickly cool the body. Immerse victim in a cool bath, or wrap wet sheets around the body and fan it. Watch for signals of breathing problems. Keep the person lying down and continue to cool the

body any way you can. If the victim refuses water or is vomiting or there are changes in the level of consciousness, do not give anything to eat or drink.

The guidance below will be used in identifying and treating heat-related illness.

Table 5-1 Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Mild Heat Strain	The mildest form of heat-related illness. Victims exhibit irritability, lethargy, and significant sweating. The victim may complain of headache or nausea. This is the initial stage of overheating, and prompt action at this point may prevent more severe heat-related illness from occurring.	• Provide the victim with a work break during which he/she may relax, remove any excess protective clothing, and drink cool fluids. • If an air-conditioned spot is available, this is an ideal break location. • Once the victim shows improvement, he/she may resume working; however, the work pace should be moderated to prevent recurrence of the symptoms.
Heat Exhaustion	Usually begins with muscular weakness and cramping, dizziness, staggering gait, and nausea. The victim will have pale, clammy moist skin and may perspire profusely. The pulse is weak and fast and the victim may faint unless they lie down. The bowels may move involuntarily.	• Immediately remove the victim from the work area to a shady or cool area with good air circulation (*avoid drafts or sudden chilling*). • Remove all protective outerwear. • Call a physician. • Treat the victim for shock. (*Make the victim lie down, raise his or her feet 6–12 inches, and keep him/her cool by loosening all clothing*). • If the victim is conscious, it may be helpful to give him/her sips of water. • Transport victim to a medical facility ASAP.
Heat Stroke	The most serious of heat illness, heat stroke represents the collapse of the body's cooling mechanisms. As a result, body temperature may rise to 104 degrees Fahrenheit or higher. As the victim progresses toward heat stroke, symptoms such as headache, dizziness, nausea can be noted, and the skin is observed to be dry, red, and hot. Sudden collapse and loss of consciousness follows quickly and death is imminent if exposure continues. Heat stroke can occur suddenly.	• Immediately evacuate the victim to a cool/shady area. • Remove all protective outerwear and as much personal clothing as decency permits. • Lay the victim on his/her back w/the feet slightly elevated. • Apply cold wet towels or ice bags to the head, armpits, and thighs. • Sponge off the bare skin with cool water. • The main objective is to cool without chilling the victim. • Give no stimulants or hot drinks. • Since heat stroke is a severe medical condition requiring professional medical attention, emergency medical help should be summoned immediately to provide onsite treatment of the victim and proper transport to a medical facility.

Heat Stress Monitoring Techniques:

Where Level C protective garments are used without regards to the use of a respirator, heat stress monitoring should begin when the air temperatures reaches 52°F. Where Level D protective garments are used heat stress monitoring should begin when the air temperature reaches 77°F. Site personnel shall regularly monitor their heart rate as an indicator of heat strain by the following method:

Check the radial pulse rate using fore- and middle fingers and by applying light pressure to the pulse in the wrist for one minute at the beginning of each rest cycle. If the pulse rate exceeds 110 beat/minute, shorten the next work cycle by one-third and keep the rest period the same. If, after the next rest period, the pulse rate still exceeds 110 beats/minute, shorten the work cycle again by one-third.

Measures to Avoid Heat Stress:

The following guidelines should be adhered to when working in hot environments:

- Know the signs and symptoms of heat related illnesses.
- Observe coworkers for the early symptoms of heat stress-related illnesses as outlined in Table 5-1. Heat Stress Monitoring techniques are provided above.
- Re-evaluate the need for PPE. (Tyvek coveralls could be replaced by an apron).
- Remove excessive PPE at breaks.
- Take frequent breaks.
- Establish work-rest cycles (short and frequent are more beneficial than long and seldom).
- Identify a shaded, cool rest area.
- Rotate personnel, alternative job functions.
- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 oz 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.
- Eat light meals before and during work shifts. Avoid highly salted foods.
- Save most strenuous tasks for non-peak heat hours such as the early morning or at night.
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration.
- Avoid double shifts and/or overtime.

5.5 Weather

5.5.1 Severe Weather

Prior to mobilization the field team personnel should be cognizant of the long range and short range weather forecast for the region in which they will be working in. If severe weather is forecasted work will be temporarily postponed until the weather is more favorable. Dailey field team members should check the weather forecast for inclement or severe weather. A weather radio or radio set on an AM channel is

the best sources for weather information and weather alerts. On the internet the Storm Prediction Center's web page can be check for alerts and warnings. http://www.spc.noaa.gov/products/wwa/.

All four seasons can bring about severe weather to the region, ranging from extremely cold temperatures to high winds and thunder and lightning storms. Hurricanes have been known to hit the northeast and while rare tornados do occur in the northeast. In the event of server weather is forecast the following steps should be taken:

- Temporarily stop and secured the site.
- Seek shelter in a vehicle or indoor location.
- Stop all work and seek a safe area when lightning is within range of the site (by the time you hear thunder, you are ALREADY within lightning range). Safe areas include low areas (NOT subject to flash floods), grounded metal structures or vehicles.
- Shut down generators and all electrical motors in an orderly manner to protect the equipment from electrical surges and abrupt power loss.
- Move all personnel off crawler-type equipment and boom equipment. Lower crane booms.
- When working in low areas, be alert for the potential of flash flooding and plan a route to higher ground.
- Work may resume 30 minutes after the last flash of lightning is observed and last rumble of thunder is heard.

6.0 Physical Hazards

6.1 Back Safety

Using the proper techniques to lift and move heavy pieces of equipment is important to reduce the potential for back injury. The following precautions shall be implemented when lifting or moving heavy objects:

- Bend at the knees, not the waist. Let your legs do the lifting;
- Do not twist while lifting;
- Bring the load as close to you as possible before lifting;
- Be sure the path you are taking while carrying a heavy object is free of obstructions and slip, trip and fall hazards;
- Use mechanical devices to move objects that are too heavy to be moved manually; and,
- If mechanical devices are not available, ask another person to assist you.

6.2 Construction Equipment

The use of construction equipment on a project such as loaders, excavators, dump trucks compactors pose the potential hazard of employees being struck by the equipment or caught between the equipment and a fixed object such as a wall.

General basic personal protective equipment to be worn on site (Support Zone [outside construction trailers and port-a-johns], Contamination Reduction Zone, and Exclusion Zone) will require all personnel to wear steel-toed boots, hard hat, high visibility garment, and safety eyewear. Personnel shall not remain in the vicinity of construction equipment unless it is required for their work responsibilities.

When equipment is being unloaded or loaded personnel are forbidden from standing under suspended loads. When working around construction equipment, employees must:

- Make sure that the operator/driver is aware of your presence/activities;
- Stay in the operator's line of sight, don't work in his/her blind spot;
- Approach areas where equipment is operating from a direction visible to the operator;
- Be aware of the swing radius of the excavator and sudden movement of equipment;
- Do not walk or work underneath loads handled by digging equipment;
- Stand away from trucks being loaded or unloaded to avoid being struck by any spillage or falling materials; and,
- Cell phone, text messaging or the use of personal headsets is prohibited when working near construction equipment.

Additionally, when samples are collected from an excavator bucket the collector must follow a communication and work protocol to ensure that the equipment operator is aware of their presence, the bucket has to be lowered to the ground while samples are collected, and during sample collection the

equipment operator has to remove his hands from the controls; it is preferred that the equipment be completely turned off and de-energized while sample collection occurs. The operator will not re-engage the equipment until the sample collector has left the area.

6.3 Excavation Hazards

The principle hazards associated with excavation and trench activities are striking buried utilities, being struck by material being handled and engulfment from soil caving in. In addition, excavations and trenches may be classified as permit required confined space so there is a potential that the atmosphere may contain hazardous gases or vapors, or be oxygen deficient.

Employees and subcontractors will not enter trenches or other excavations. In addition, personnel shall maintain at least 3 foot distance from the edge of the excavation.

In accordance with OSHA, a competent person must conduct daily, or more frequent, inspections of each trench or excavation, the adjacent hazards and protective systems for evidence of possible cave-in/failure of protective systems, hazardous atmosphere, and other hazardous condition and determine the necessary precautions to take.

Employees/subcontractors shall not enter an excavation or trench if they feel that entry is unsafe or does not meet the requirements presented below:

- A minimum of 3 days prior to digging, call Dig Safely, NY at 811 or 1.800.962.7962. All underground utilities in the work area must be positively identified by calling 811. Markings made during the utility investigation must be maintained throughout the course of work.
- When personnel are required to enter a trench or excavation over 4 feet deep, an adequate means of exit, such as a ladder, steps, or ramp must be provided and located so as to require no more than 25 feet of lateral travel. Ladders will extend at least 3 feet above the edge of the trench and will be securely staked in place.
- Walkways or bridges with standard railings and toe board must be provided when personnel or equipment are required to cross over excavations.
- The walls and faces of excavations in which personnel are exposed to danger from moving ground must be guarded by a shoring system, sloping of the ground, or some other equivalent means as required by 29 CFR 1926 Subpart P.
- No person shall be permitted under loads handled by excavators or other material handling equipment.
- The excavated soil shall be temporarily stockpiled on plastic sheeting at one side of the excavation. At a minimum, the toe of the spoil pile shall be at least 2 feet away from the edge of the excavation. The spoils pile shall be moved farther back in proportion to the depth of the excavation. The spoils pile height shall not exceed the depth of the excavation and shall be sloped to prevent the soil and rocks from sliding into the excavation. It is expected that the volume of excavated soils will be relatively small and will ultimately be placed in NYS DOT-approved 55-gallon drums for temporary staging and ultimate off-site disposal. Excavated soil will be transported of-site to a National Fuel Gas licensed and permitted disposal facility by a National Fuel Gas permitted Waste Transporter.
- Protective system(s) to prevent cave-in shall be used when personnel enter excavations 5 feet or greater in depth or if the competent person determines it is necessary at shallower depths.

Protective system(s) shall be complaint with the requirements of 29 CFR 1926 Subpart P. A Registered Professional Engineer must design protective systems for excavations/trenches 20 feet or greater in depth.

- Where protective systems are used such as trench boxes, hydraulic shoring, etc., they shall be used in accordance with the manufacturer's specifications and limitations. The manufacturer's tabulated data for such systems, sealed by a Professional Engineer licensed in the State of New York, must be maintained on the project.
- Employees/subcontractors shall not enter an excavation 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. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.
- Excavation or trenches that pose an atmospheric hazard must be tested for oxygen content, explosive gases/vapors and toxic gases/vapors (i.e. Carbon monoxide, Hydrogen sulfide, contaminates of concern) prior to and during entry.

6.4 Electrical Hazards

Potential electrical hazards include electric shock, electrocution, burns, fires, and explosion. Electrical cords used to carry electrical power pose a trip and fall hazards. The use of portable generator not alone poses an electrical hazard but also the hazard associated with exposure to carbon monoxide.

All temporary and permanent electrical work, installation, testing and maintenance and all electrical equipment and appliances shall conform to the requirements of the National Electrical Code and comply with the requirements of 29 CFR 1926 Subpart K.

To prevent potential electrical incidents the following basic electrical practices must be followed at all times while working on this project.

- Only qualified electricians with full knowledge of the electrical code requirements will be allowed to perform electrical work.
- Temporary electrical cords must be rated for extra hard usage or hard usage and must be of the three-wire type with a grounding pin and a grounding receptacle. Look for the following letters on the cord: S, SJ, ST, or SO markings on the cord.
- Temporary electrical cords must be protected by shunt boards or elevated a minimum of 8 feet (except over streets where they need to be at least 18-feet above the road). They must be kept clear of walkways and other location where they may be exposed to damage or create a trip hazard. Do not hang extension cords with bare wire, nails, staples or objects that will cut/damage cords.
- Visually inspect all electrical equipment before use. Remove from service any equipment with frayed cords, missing ground prongs, cracked tool casings, etc.
- Electrical tools and equipment must be grounded, of the double insulated or cordless type.
- All 120 volt 15 and 20 amp receptacles must be protected by a Ground Fault Circuit Interrupter (GFCI). Follow manufacturers’ recommended testing procedure to insure GFCI is working correctly.

- Temporary lighting shall have guards that protect the entire bulb surface. Broken and burned-out lamps shall be replaced immediately.
- Check the work area for overhead and underground electrical utilities. Employees must be protected from overhead hazards by meeting the guidelines listed below.
  - If the overhead power line is 50 kV or less, then stay at least 10 feet away. For everything else, keep at least 35 feet away. Contact the power company if power lines needed to be, moved, de-energized and grounded, or have insulated sleeves installed.
- In potentially hazardous environments electrical equipment must meet the National Electrical Code (NEC) classification for hazardous locations. Consult the RHSM for the proper type of equipment
- When work is to be performed on electrical equipment, lockout procedures (National Fuel Gas's CEHSP S12.00) are required to ensure that the equipment is de-energized and isolated.
- Energized wiring in junction boxes, circuit breaker panels and similar places shall be covered at all times. The covers must be secured.
- Fuel generators before use and re-fuel only after the engine has been shut down and allowed to cool.
- Never use a portable generator indoors. Locate a generator so that the exhaust is downwind from your position or locations where carbon monoxide can enter (e.g., confined spaces, indoor locations etc.)

6.5 Falls

6.5.1 Same Level

Falls from slips and trips are common workplace occurrences that can result in serious injuries and disabilities. The most common types of falls are falls at the same level. Fall hazards exist in most workplaces including offices, manufacturing and construction. Slips and trips can be prevented by following these guidelines:

- Personnel shall be vigilant in providing clear footing, clearly identifying obstructions, holes, stick ups, or other tripping hazards and maintaining an awareness of uneven terrain and slippery surfaces.
- Walking and working surfaces shall be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.
- Makeshift substitute ladders such as toolboxes, buckets, and coolers shall not be used.
- The use of cellular telephones (testing, making or receiving calls) for personal use is prohibited in the work area.
- Walk around, not over or on, debris or equipment that might have been stored in the work area.
- Don't jump from platforms or truck beds.
- When carrying equipment, identify a path that is clear of any obstructions. It might be necessary to remove obstacles to create a smooth, unobstructed access point to the work areas on site.

6.5.2 Elevated Surfaces

Falls from an elevation greater than 6 feet above a lower level or less than 6 feet above dangerous equipment can result in serious injury and even death. To prevent falls from elevations the walking and working surface must be surrounded on all open sides by standard railings or their equivalent (fence, barricade or cover), or by employees who are protected by a personal fall arrest system.

6.6 Hand Tools

Hazards associated with hand tools are cuts, lacerations, electrocution, and struck by flying objects. Frequent and prolonged use of hand tools can cause soreness, aches, pains, and fatigue, which, when ignored, can lead to chronic musculoskeletal injuries (MSIs). Many injuries have been caused by the use of fixed open blade knives such as a jack knife or box cutter.

Basic safety rules can help prevent hazards associated with the use of hand tools:

- Use the right tool for particular work activity being conducted (e.g., don't use a file or a screwdriver as a pry bar).
- Examine each tool for damage before use (e.g., worn, splintered handles, etc.) and do not use damaged tools.
- Use properly the right personal protective equipment (e.g., eye protection, gloves, hearing protectors).
- Hold work in a clamp or vise, not in your hand.
- Position your body securely while working with the tool.
- Plastic covered tool handles are for comfort only, not protection from electrical current.
- Claw hammers are for driving and removing finishing and common, unhardened nails. Don't strike other steel tools such as chisels, punches or masonry nails with a claw hammer.
- When working with a wrench, always pull the wrench, never push the wrench.
- Hand sockets should never be used on power or impact wrenches. Hand sockets usually have bright finish but may have black finish.
- Discard any chisel or punch that is chipped or mushroomed.
- Don't use a screwdriver for prying, punching, chiseling, scoring or scraping. Screwdrivers should only be used to drive or remove screws.
- Never use an extension bar such as a length of pipe to increase leverage on a wrench. This could result in breakage of the wrench and personal injury.
- Ball peen hammers of appropriate size or hand drilling hammers should be used to strike chisels, punches and star drills. Do not use the claw hammer.
- Select a wrench whose opening exactly fits the nut. Too large an opening can spread the jaws of a wrench. Too large a box- or socket wrench can mar or turn the corners of the nut. Exercise care in selecting inch wrenches for inch fasteners and metric wrenches for metric fasteners.
- Only spark-resistant tools made from brass, plastic, aluminum, or wood to shall be used around flammable substances.

- For continuous work, use comfort grips or gloves, take frequent breaks, avoiding awkward positions, and consider using a power tool.

6.7 Noise Exposure

The use of construction equipment can expose the field team to noise levels that exceed the OSHA PEL of 90 dB for an 8-hour day. Exposure to noise can result in the following:

- Temporary hearing losses where normal hearing returns after a rest period.
- Interference with speech communication and the perception of auditory signals.
- Interference with the performance of complicated tasks.
- Permanent hearing loss due to repeated exposure resulting in nerve destruction in the hearing organ.

Noise exposures during potential site activities will be relatively minor and very brief. Potential sources of noise at the site include hand power tools and trucks. For that reason personal noise monitoring will not be conducted during the proposed activities, Workers must follow this general rule of thumb: If the noise levels are such that you must shout at someone five (5) feet away from you, you need to be wearing hearing protection. Workers can wear either disposable earplugs or earmuffs but all hearing protection must have a minimum noise reduction rating (NRR) of 27 dB.

6.8 Utility Hazards

6.8.1 Underground Utilities

It is the responsibility of the National Fuel Gas contractor to contact Dig Safe NY (811) for a utility clearance at least three (3) working days prior to initiation of any subsurface work. Work will not begin until the required utility clearances have been performed.

Public utility clearance organizations typically do not mark-out underground utility lines that are located on private property. Personnel and the subcontractor must exercise due diligence and try to identify the location of any private utilities on the property being investigated. The contractor can fulfill this requirement in several ways, including:

- Visually inspect the proposed work areas with National Fuel Gas personnel to identify any visual hazards.
- Review subsurface utility drawings provided.
- Clearly identify and mark no-work zones.
- Hand dig in the proposed excavation locations if insufficient data is available to accurately determine the location of the utility lines.

6.8.2 Overhead Utilities

Accidental contact with an energized line or arcing between a high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. While maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this.

Safe working distance shall be maintained if work will (or may) occur within 50 feet of any energized line. Safe working distance is the minimum distance which must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins, and is based on the line voltage of the power line. The following safe working distance criteria will be applied:

- Determine the voltage of the power line by contacting the utility company or owner
- Unless verified, it will be assumed that all lines are energized
- Line Voltage (Kilovolts) Minimum Safe Working Distance

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1000	45 feet

Source: American National Standards Institute, Publication B30.5

6.9 Traffic Control

During certain work tasks, the establishment of traffic control to adequately protect workers and the public may be required on-site. Site specific requirements will be determined by the site supervisor on a case-by-case basis. Only approved traffic control devices per accordance with the Manual of Uniform Traffic Control Devices (MUTCD) will be used on public road ways per accordance with the applicable State regulatory guidance. To make certain that motorists are aware of our presence, employees who are potentially exposed to traffic hazards must wear ANSI Class II or III safety vests. Work areas shall be delineated with traffic cones, or other suitable warning barriers, to prevent motorists from inadvertently driving through the area.

General traffic control precautions include placing a work vehicle between your worksite and oncoming traffic whenever possible. Not only is it a large, visible warning sign, but also if an oncoming car should fail to yield or deviate, the parked vehicle rather than your body would absorb the first impact of a crash. Turn the vehicle's wheels so that if it was struck, it would swing away from the worksite.

When working in high traffic areas, the following precautions will be implemented so that motorists are warned of your presence:

- Wear an ANSI-approved Class II or III safety vest;
- Set up work zone signs at a minimum of 150 feet in front of the work area;
- Taper cones at least 125 feet in front of work zone;
- Position vehicle upstream from work site to begin channeling traffic;
- Designate work zone with cones;
- Taper cones at least 50 feet downstream from work zone;
- Use trained flaggers;

- Use the services of local law enforcement to maintain traffic control, where deemed appropriate.

7.0 Safe Work Standards and Rules

7.1 Safe work practices

1. Perform all job duties in a responsible manner, following and complying with regulatory standards, industry standards, work practices, guidelines, and project-specific requirements governing the scope of work.
2. Be aware of the job site conditions, work environments, client operations, contractor activities, and general public (if applicable) that may impact a worker or be impacted by or affected by one's work.
3. Work in a manner that will not put oneself, other personnel or equipment or facilities at risk.
4. Identify hazardous conditions and activities in the work environment consistent with the job and training.
5. If one cannot remove a hazard, it shall be reported to the Project Manager.
6. Implement established control methods consistent with project procedures and/or training.
7. Unsafe employee actions or behavior are prohibited.
8. Employees performing inspections, construction observations, investigations, reviews, surveys or visits to remote sites shall work in teams of a minimum of two persons present (buddy system), or an alternate communication plan must be provided. Immediately report all potentially dangerous conditions and injuries, regardless of severity, to the National Fuel Gas field supervisor.
9. Report all accidents, injuries spills/releases, etc., or any equipment/personal property damage or near miss incidents to the National Fuel Gas field supervisor immediately.

7.2 Personal standards

1. Fighting and gambling are not permitted.
2. Be considerate of the safety and welfare of others. Distracting other's attention or engaging in practical jokes and horseplay is prohibited.
3. Employees are not permitted to use, sell or distribute, be under the influence, or have in their possession any controlled substances, drugs, or alcohol. The only exception is if an employee is taking prescription medication(s) under the direction of a physician. It is then the responsibility of the employee to notify one's Project Manager if the medication may impair their ability to perform their job function in a safe manner, in which case they shall be removed from that task.
4. Smoking is prohibited in all areas within the project perimeter, including construction trailers.
5. Be alert at all times. Obey safety signs, heed warning signs and instructions.
6. Report unsafe equipment, conditions, and actions or behavior to one's task leader or supervisor promptly.
7. Avoid back injuries by knowing one's capabilities, using proper lifting techniques, and seeking assistance when needed.
8. Workers shall operate vehicles in a safe and conscientious manner.

9. All workers shall direct any questions or concerns they may have about the project Health and Safety Plan (HASP), job tasks, instructions or conditions to the Project Manager.

7.3 General safety rules

1. Workers are required to practice “good housekeeping” when performing job tasks. Such practices include overseeing that work areas are kept clean and organized; using approved cleaning materials for tools and equipment;; and leaving a work area clean and orderly. This includes office work stations and occupancies.
2. Proper packaging and disposal of waste materials including hazardous materials. Wastes potentially generated during the work include the following:
    a. Un-impacted soil
    b. Impacted groundwater
    c. General un-impacted trash and construction waste
3. One should plan work tasks before beginning work and consider any hazards that may exist and how to avoid them through proper work practices.
4. One should keep an eye out for and take care of one’s “buddy” in the field.
5. Obey all warning signs (e.g., “Do Not Enter,” “No Smoking,” “Eye, Hearing or Respiratory Protection Required,” “Permit Required Confined Space,” “Authorized Personnel Only”).
6. Do not jump from any elevated surface or platform, including truck beds, equipment and scaffolding.
7. Taking shortcuts leads to injury. Use appropriate ladders, platforms and stairs.
8. Do not block, deface or remove any signage, barricade or fencing without approval.
9. Keep passageways clean and clear of debris, materials, hoses, cords, and tripping obstructions. Items should be moved to low activity areas or overhead.
10. Permits may be required when performing non-routine tasks and work involving hazards. Seek advice from the Project Manager.
11. Use only designated sanitary facilities.
12. Be alert to work going on, around or above you including contractor activities and motoring public vehicles.
13. Be familiar with project emergency procedures. Report all emergency situations to the Project Manager immediately.
14. Hand tools, electronic devices and equipment may not be used for any purpose other than their intended use. Damaged equipment and tools with worn part(s) shall be reported to a supervisor or task leader for repair or replacement.
15. Electric power tools must be properly grounded or double insulated. Electric power tools shall be Ground Fault Circuit Interrupter-protected when in use at all times.
16. Defective tools and equipment, frayed and ungrounded electrical cords and unguarded tools and machinery shall not be used. Report same to the Project Manager.
17. Employees shall not remove floor covering, guard rails, or other working surfaces from any floor or perimeter side opening without approval by the Project Manager.

18. Defective or unsecured ladders shall not be used.
19. Employees shall not ascend or descend a ladder without free use of both hands while facing the ladder.

7.4 Safety equipment rules

1. Always wear assigned safety equipment and Personal Protective Equipment (PPE).
2. Always use protective equipment in accordance with manufacturer's instructions.
3. All employees, subcontractors, visitors, and vendors shall wear a hard hat, high visibility vest, sturdy work boots with protective toe cap and eye protection (e.g. safety glasses with attached side shields) on construction projects.
4. Wear clothing suitable for the work being performed. Minimum attire consists of long pants and shirt with a minimum 4-inch sleeve.
5. Hearing protection devices shall be used when exposed to elevated noise levels of 90 dBA and higher. Personal noise monitoring will not be conducted during the proposed activities; personnel must follow the general rule of thumb: **If the noise levels are so loud that you must shout at someone who is 5 ft away from you, you need to be wearing hearing protection**.
6. Respirator use may be required in areas where dust, gas or fumes exist.
7. Modification or alteration of any safety equipment is prohibited as it changes the equipment's design strength and manufacturer's certifications.
8. PPE use shall be consistently enforced in accordance with rules established for the project and federal and state safety regulations.

7.5 Work ergonomic rules

Use proper methods as outlined below to perform all job functions so as to minimize the risk of physical injury.

1. Bend at the knees, not the waist. Let your legs do the lifting.
2. Take reasonable precautions when lifting heavy or large objects that could cause back injury or hernia.
3. Do not exceed one's capability and strength. Seek assistance.
4. Make suitable adjustments to one's workstation including office furniture, chair, keyboard platform, computer monitor for comfort, equipment and work.
5. Use mechanical devices to move objects, such as drums, equipment that is too heavy to be moved manually. If mechanical devices are not available ask another person to assist you
6. Avoid routine, repetitive motion hand activities. Integrate varying motions and body parts.
7. Change work routines (e.g., phones, typing, files). Stretch and take mini-breaks.

7.6 Hazardous Waste Site Rules

1. The "buddy system" or communication plan will be used at all times by all field personnel.
2. Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in the immediate work area and

the decontamination zone. Water and Ice may be consumed in all areas to prevent heat stress but precautions must be taken to prevent contamination of the water and ice.

3. Smoking is prohibited in all work areas. Matches and lighters are not allowed in these areas.
4. Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking or any other activities.
5. Beards or other facial hair that interfere with respirator fit are prohibited.
6. All equipment must be decontaminated or properly discarded before leaving the site in accordance with the project.
7. Avoid contact with potentially contaminated substances or materials. Do not walk through puddles, pools, mud, or handle soils without protective gloves, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or the ground. Do not place monitoring equipment on potentially contaminated surfaces (e.g., ground, etc.)
8. Field personnel will perform only those tasks which they are qualified to perform.

8.0 Air Monitoring

8.1 Direct Reading Instrumentation

As a precautionary measure, the PID will be used to screen the work area for VOCs during subsurface investigations. If the PID indicates sustained (15-minute) breathing zone vapor concentrations in excess of 1 unit or more Level C respiratory protection, as described in Section 9.0 of this HASP, will be donned.

Dust would be generated during excavation. Depending on the severity of the problem a light mist of water can be applied to the sidewalls of the excavation to suppress dust generation. If visible dust is generated even after these engineering controls have been implemented, respiratory protection, as described in Section 9.0 of this HASP, will be donned.

8.2 Calibration and Recordkeeping

The PID will be calibrated to a 100 ppm isobutylene-in-air mixture on a daily basis. All PID calibrations and readings should be recorded in a project field notebook or on dedicated air monitoring result sheets.

9.0 Personal Protective Equipment

The proper use of appropriate personal protective equipment (PPE), in combination with effective engineering and administrative controls, can provide employees and subcontractors with adequate protection against potential workplace hazards and reduce the potential for workplace injury and illness. The Personal Protective Equipment Program is found in **SH&E SOP No.115.**

In accordance with OSHA's PPE standard (29 CFR 1910.132) is required to assess workplace(s) to determine if hazards are present which necessitate the use of PPE; and, if such hazards are present. Therefore, this HASP will serve as the certificate of hazard assessment for this project that involves work activities that require the use of PPE.

The PPE to be worn for general site activities are described below.

Per National Fuel Gas's policy, hard hats are to be worn at all times by all field personnel while performing work at the site. Please note that contractors working for National Fuel Gas are not permitted to wear white or "National Fuel Gas blue" hard hats. Employees and subcontractors will be issued yellow or grey hard hats for this program.

9.1 Level D Ensemble

Level D personal protective equipment for this project shall consist of: shirts with sleeves and long trousers that are ankle length; approved hard hats, safety spectacles with side shields, steel-toe protective footwear and a high visibility vest or other high visibility outer garment when in construction area or other non-office work areas. In addition, employees are required to use the appropriate protective gloves and carry gloves with them at all times when in the construction area or other non-office work areas. As necessary hearing protection will be used.

It is expected that under normal circumstances, all work described in this HASP will take place in Level D PPE. This will be re-evaluated if necessary during site activities.

9.2 Modified Level D Ensemble

Level D ensemble will be modified to where there is a potential for dermal (skin) exposure to the chemical contaminants of concern. Modified Level D ensemble will consist of the PPE required for Level D with the addition of the following:

- Chemical-resistant overalls (Tyvek or Tyvek QC)
- Inner gloves: Best Safety N-DEX or equivalent
- Outer gloves: Ansell-Edmont SOL-VEX (Nitrile) or equivalent
- Protective cover boots

9.3 Level C Ensemble

Level C ensemble will be used where air monitoring will be performed in the worker's breathing zone indicates a sustained (15 minutes) airborne concentrations of VOC at or above 5 ppm or particulates concentrations in excess of 1.0 mg/m^3 or more above background. In addition Level C respiratory

protection should also be donned if odors become objectionable at any time or if respiratory tract irritation is noticed.

Level C ensemble may incorporate the Modified Level D protection or may be used with Level D protection if a dermal hazard is not present Level C specification is as follows:

- Half-mask air-purifying respirator with combination organic vapor cartridges /P-100 dust filter
- Cartridge change out after daily use or immediately if breakthrough is perceived.

9.4 Respiratory Protection

has developed a Respiratory Protection Program in accordance with the requirements of 29 CFR 1910.134. The Respiratory Protection Program is found in **SH&E SOP 114**.

All employees who are expected to don respiratory protection must have successfully passed a qualitative or quantitative fit-test within the past year for the brand, model and size respirator they plan to don. Documentation of a physician's approval for wearing a tight-fitting respirator for each applicable personnel as well as documentation of successful fit tests for each of the personnel will be provided to the National Fuel Gas Project Manager on site before respirators are to be used.

Users of an air-purifying respirator shall perform a seal check (positive and negative check) to ensure that an adequate seal is achieved each time the respirator is put on. Instruction for performing a seal check is found in Attachment G for SOP 114.

If worn, respirators will be cleaned after each use with respirator wipe pads and will be stored in plastic bags after cleaning. Respirators will be thoroughly cleaned using disinfectant material within one week following use. Refer to the cleaning instructions provided with the respirator or specified SOP 114, Attachment G.

9.5 Inspection of PPE

It is the responsibility of each employee/subcontractor to inspect their personal protective equipment for defects prior to field activities. Defective PPE must be replaced. Prior to donning PPE must be inspected, for damage or defects. Promptly remove any protective clothing that becomes ripped or torn during a particular task.

9.6 Other Safety Equipment

The following additional safety items will be available at the site:

- Eyewash
    - When work does not involve chemicals - Sealed portable, hand-held eyewash bottles
    - When work involves chemicals - An Ansi Z358.1-1998 compliant station capable of providing at least a 15 minute unbroken stream.
- First aid kit / Blood borne Pathogen Response kit
- 2 A 10 BC multi-purpose dry chemical fire extinguisher (4.5 pounds).
- Hearing protection with a minimum noise reduction ration (NRR) of 27
- Portable phones

10.0 Site Control

10.1 Designation of Zones

To prevent both exposure of unprotected personnel and migration of contamination due to tracking by personnel or equipment, hazardous work areas will be clearly identified and decontamination procedures will be required for personnel and equipment leaving those areas.

10.1.1 Exclusion Zone

The exclusion zone (EZ) as established by the remediation contractor must be established around the work area or temporary stockpile areas were contamination is present or suspected. The perimeter of the exclusion zone must be clearly identified with traffic cones, protective tape, temporary construction fencing, or other similar devices so that employees, subcontractors, visitors, and client or host employer personnel are aware of the work being conducted.

Any personnel and visitors entering the exclusion zone must meet the medical and training requirements as found in Section 12.0 of this plan and have the necessary PPE to enter the EZ.

10.1.2 Contamination Reduction Zone

The Contaminant Reduction Zone (CRZ) is between the Exclusion and Support Zone (SZ) and provides a location for the removal of PPE which has contacted material with elevated chemical presence, and for decontamination of personnel and equipment. Supplemental safety equipment, such as fire extinguishers, portable eyewash, and extra quantities of PPE may be stored in this area. The Contamination Control Line separating the CRZ and the SZ will be designated with caution tape, or other suitable material. Exit from the EZ will be through a designated decontamination corridor. Personnel assisting with decontamination will wear a level of PPE at or one below that used by personnel in the EZ.

Vehicles, equipment and personnel will exit the exclusion zone through the CRZ before entering the support area. All heavy equipment used in the exclusion zone shall be decontaminated on the decon pad using a pressure washer and soap prior to entering the support zone.

10.1.3 Support Zone

At this site the support zone will include the area outside of the exclusion zone and contamination reduction zone.

10.1.4 Site Access Control

A sign in/out log of personnel, including visitors, who enter the site, will be maintained.

10.1.1 Parking and Staging Areas

Vehicles parked on the public streets will be parked in legal parking spaces.

11.0 Decontamination

All personnel leaving a contaminated area shall be appropriately decontaminated; all contaminated clothing and equipment leaving a contaminated area shall be appropriately disposed of or decontaminated. Water used for decontamination will be collected and will be tested and appropriately disposed of.

In the CRZ, personnel will remove for disposal their outer protective garments and other consumable items. Non-disposable items such as rubber over boot, and hard hats should be decontaminated by washing them with a soap and water solution and allowed to air dry before bringing them out to the CRZ. The outside of respirators should be initially wiped down with a soap and water solution, followed by a complete cleaning following the manufacturer's recommendations. As an interim measure, clean pre-moisten (non-alcohol) wipe pads can be used to clean the inside of the respirator. Personnel must wash hand and face prior to using tobacco products, eating, drinking or applying cosmetics (sun screen).

11.1 Personal Decontamination

shall establish a decontamination zone adjacent to the EZ. Proper decontamination is required of all personnel before leaving the site. Decontamination will occur within the CRZ.

11.2 PPE Decontamination

Impacted disposable PPE, such as Tyvek coveralls, gloves, etc. will be removed in the decon zone and placed in drums. Final disposal of contaminated PPE will be in Section 2.5.

If worn, respirators assigned to an individual will be cleaned after each use with respirator wipe pads and will be stored upright in plastic bags. Respirators will be thoroughly cleaned using disinfectant material within one week following any respirator use.

12.0 Medical Monitoring and Training Requirements

12.1 Medical Monitoring

All personnel/subcontractors performing activities covered by this HASP must be active participants in a medical monitoring program that complies with 29 CFR 1910.120(f). Each individual must have completed an annual surveillance examination and/or an initial baseline examination within the last year prior to performing any work on the site covered by this HASP. The medical monitoring includes the medical evaluation criteria for respirator use as found in 29 CFR 1910.134 (c) (1) (ii).

12.2 Health and Safety Training

12.2.1 HAZWOPER

All personnel/subcontractors, performing activities covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120 (e). Each individual must have completed an annual 8-hour refresher training course and/or initial 40-hour training course (and 8-hr supervisor training, if relevant) within the last year prior to performing any work on the sites covered by this HASP. Copies of the initial 40-hr training document and the most recent 8-hr refresher will be provided to the National Fuel Gas Project Manager on site prior to commencing work on site.

12.2.2 Pre-Entry Briefing

Prior to the commencement of project activities, a pre-entry briefing will be conducted by the SSO to review the specific requirements of HASP, applicable site rules, PPE requirements, MSDS etc. Attendance at the pre-entry meeting is mandatory for all personnel covered by this HASP and must be documented on the attendance form provided in Attachment C. All documentation should be maintained in the project file with a copy given to the National Fuel Gas Project Manager on site.

12.2.3 Tailgate Meetings

As applicable tailgate safety meetings for personnel and subcontractors will held at the beginning of each task or work operation and at least daily thereafter, according to the various circumstances involved or when necessary to clear working procedures. Attendance at the daily tailgate meeting is mandatory for site personnel and must be documented on the attendance form provided in Attachment C. All documentation should be maintained in the project file with a copy given to the National Fuel Gas Project Manager on site.

Meetings will cover relevant health and safety issues, site activities, changes in site conditions, and a review of topics covered in the pre-entry briefing as they apply to daily activities. As part of the tailgate safety meeting, employee feedback (comments, questions, health or safety concerns) are welcomed. Issues addressed in the safety meetings will be documented and shall include the date, attendees, subjects discussed and names of individual(s) who conducted the meeting. Signatures must be obtained from all attending.

12.2.4 Pre-Entry Briefing

shall hold a pre-entry briefing at the beginning of construction for employees/subcontractors working on the site. Additional briefings will be held for any new personnel who come to the site. The briefing shall

provide information required for orientating themselves to site condition, health and safety requirements and hazards controls measures.

This section of the HASP has been written to comply with 29 CFR 1910.38 (a).

emergency response actions may include evacuation and medical/first aid as described within this section below. As such this section is written to comply with the requirements of 29 CFR 1910.38 (a).

The basic elements of an emergency evacuation plan include:

- Employee training,
- Alarm systems,
- Escape routes,
- Escape procedures,
- Critical operations or equipment,
- Rescue and medical duty assignments,
- Designation of responsible parties,
- Emergency reporting procedures and
- Methods to account for all employees after evacuation.

12.3 Worker Training

Employees/subcontractors must be instructed in the site-specific aspects of emergency evacuation. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed.

12.4 Alarm System/Emergency Signals

Verbal communications will be adequate to warn employees/subcontractors of hazards associated with the immediate work area. The property is occupied but may not have access to facility phones. Therefore, the SSO will bring a portable phone to the site to ensure that communications with local emergency responders is maintained, when necessary.

12.5 Escape Routes and Procedures

Emergency evacuation routes will be designated at the site, prior to initiating field activities. As field activities progress, it will be necessary to modify the evacuation routes, in accordance with site conditions and layout. Evacuation routes must be clear of obstructions. Typically evacuation routes will be toward the designated muster point. Depending on the location of the site activities at the time of the emergency, this muster point may be adjusted as the site work progresses to the site personnel during the daily tailgate safety meeting The escape route from the site and an emergency muster point will be determined and provided to all workers during the project mobilization and will be discussed during the pre-entry briefing.

12.6 Employee Accounting Method

The SSO is responsible for identifying all personnel on-site at all times. Subcontract employees will notify the SSO when they enter and leave the site. The SSO will account for all personnel and subcontract employees following an evacuation.

12.7 Rescue and Medical Duty Assignments

The phone numbers of the police and fire departments, ambulance service, local hospital, and National Fuel Gas emergency contacts are provided in the emergency reference sheet. This sheet will be posted in the site vehicle.

In the event an injury or illness requires more than first aid treatment, the SSO will designate an AECOM employee or contractor employee to accompany the injured person to the medical facility and will remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the on-site project manager and the CHSM, who will, in-turn, notify the National Fuel Gas Project Manager on site immediately.

12.8 Incident Reporting and Investigation

Any incident resulting in injury, illness, Close Call, or property damage requires a Root Cause Investigation Report / Preventative Action Plan. The investigation shall be conducted as soon as emergency conditions are under control. The purpose of the investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided. An incident investigation form is presented in Attachment E of this HASP. The injured employee's supervisor, the Project Manager, and the RHSM should be notified immediately of the injury. Subcontractors of shall also follow similar procedure with respect to incident reporting and investigation.

In addition, the National Fuel Gas Project Manager on site must be notified immediately of any incident. The SSO must provide National Fuel Gas with a completed Contractor Injury Form within 24 hours of the incident. Additionally for injuries, accidents, or Close Calls, and property damage to anyone on site or to Members of the Public, the SSO will be required to prepare a Root Cause Investigation Report with Preventative Action Plan (RCIR/PAP). AECOM and their subcontractors are not to perform any work on the task or activity where the incident occurred until National Fuel Gas considers their RCIR/PAP acceptable. They can, however, perform work on all other tasks or activities on the project while awaiting National Fuel Gas's acceptance of the aforementioned documents.

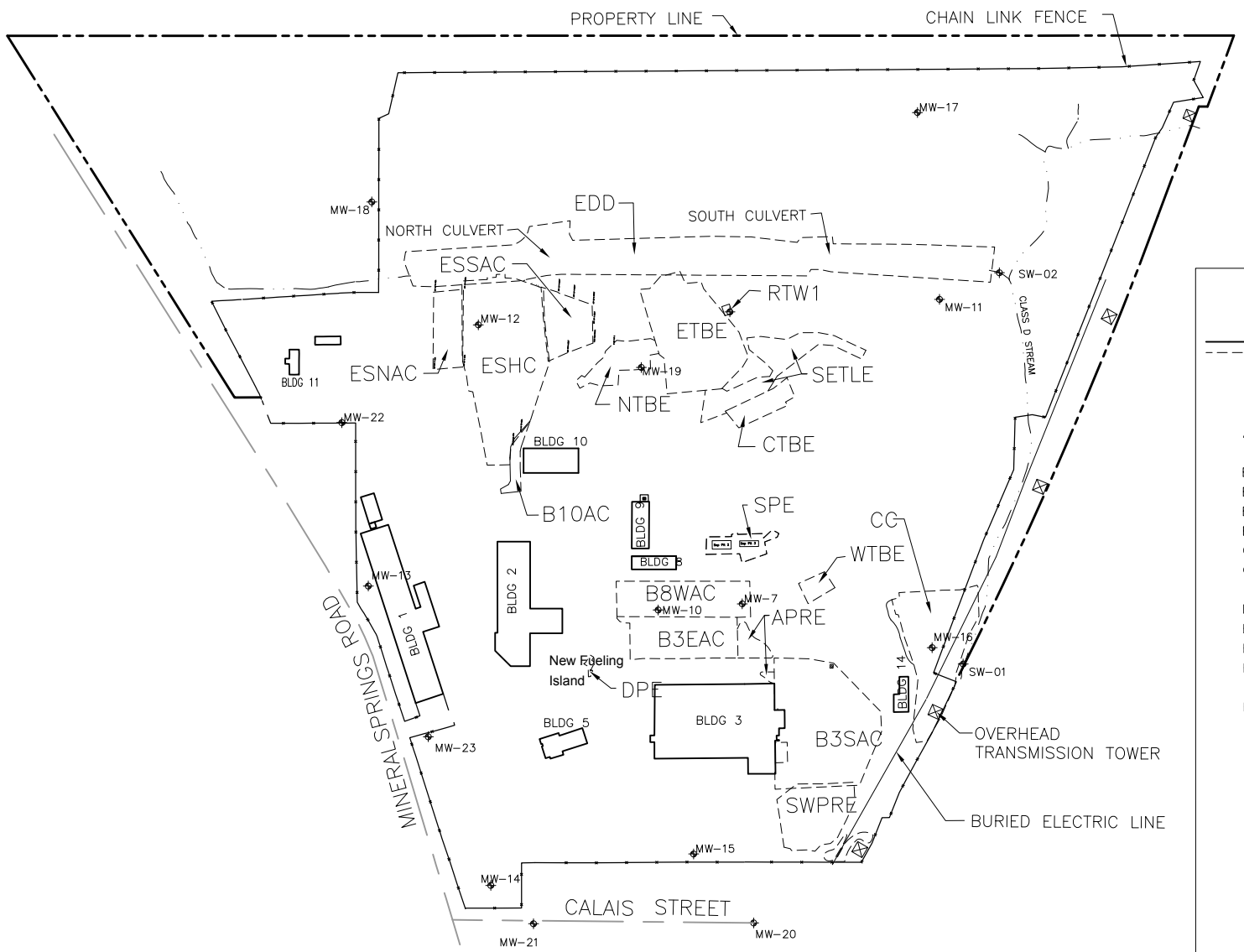
12.8.1 Emergency Contacts

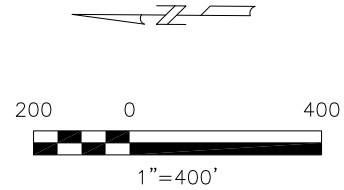
Emergency Coordinators / Key Personnel			
Name	**Title**	**Telephone Number**	**Cellular Phone**
TBD	**Project Manager**		
Brad Walker	**National Fuel Gas Project Manager**	**(716) 667-5559**	**(716) 517-5146**
Paul White	**National Fuel Gas Property Manager**	**(716) 827-2345**	**(716) 570-2757**
TBD	**Project Engineer**		
	Office Manager		
TBD	**Corporate Health & Safety Manager**		
Incident Reporting	**Corporate Safety Administrator**		

Organization / Agency	
Name	**Telephone Number**
Police Department	911
Fire Department	911
State Police	911
Ambulance Service ***(EMT will determine appropriate hospital for treatment)***	911
Poison Control Center	800-222-1222
National Response Center	800-424-8802
Dig Safe NY	811

Direction and maps are provided in Section 12.8.3

12.8.2 Route to Hospital





LEGEND

	EXISTING STRUCTURE
	REMEDIAL CONSTRUCTION
	MONITORING WELLS
APRE	ADDITIONAL PURIFIER RESIDUALS EXCAVATION
B3EAC	BUILDING 3 EAST ASPHALT CAP
B3SAC	BUILDING 3 SOUTH ASPHALT CAP
B8WAC	BUILDING 8 WEST ASPHALT CAP
B10AC	BUILDING 10 ASPHALT CAP
CC	CLAY CAP
CTBE	CENTRAL TAR BOILS EXCAVATION
DPE	DIESEL PAD EXCAVATION
EDD	EASTERN DRAINAGE DITCH
ESHC	EASTERN SWALE HDPE CAP
ESNAC	EASTERN SWALE NORTH ASPHALT CAP
ESSAC	EASTERN SWALE SOUTH ASPHALT CAP
ETBE	EASTERN TAR BOILS EXCAVATION
NTBE	NORTHERN TAR BOILS EXCAVATION
RTW1	RECOVERY TEST WELL AND DNAPL SHED
SETLE	SOUTHEASTERN TAR LENSES EXCAVATION
SPE	SEPARATOR PITS EXCAVATION
SWPRE	SOUTHWEST RESIDUALS EXCAVATION
WTBE	WESTERN TAR BOILS EXCAVATION

AECOM

MINERAL SPRINGS ROAD FORMER MGP SITE

04870-026-400

SITE PLAN

DATE: 09/10/09 | DRWN: RCW/WFD | FIGURE 1

ATTACHMENT A

Health and Safety Plan Sign-off Sheet

Health and Safety Plan Sign-off Sheet

Environmental Oversight of Remedy Implementation

National Fuel Gas Distribution Company

Mineral Springs Facility, West Seneca, New York

I have received a verbal site specific HASP review for the above-referenced site. I have been informed of the location/availability of the HASP, Material Safety Data Sheets and Emergency Equipment. During the orientation I was given an opportunity to ask questions.

Name	Signature	Company	Date

ATTACHMENT B

Job Safety Analysis

JSA No. 00 – Blank JSA Form

JSA No. 01 – Driving Safety

JSA No. 02 – Groundwater Sampling (Low Flow)

JSA No. 03 – Oversight and System Connection

JSA No. 04 – Operation and Maintenance

JSA No. 05 – Excavation

JSA No. 06 – Boring and Well Installation

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐Office ☐ Construction	☐ New ☐ Revised	Date:
Work Activity:		
Personal Protective Equipment (PPE):		

Development Team	Position/Title	Reviewed By	Position/Title	Date

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
		•	•
		•	•
		•	•
		•	•
		•	•

Page __ of __

Job Safety Analysis

JSA Type: ☒ Investigation ☒ O&M ☐ Office ☒ Construction ☐ Other	☐ New ☒ Revised	Date: 3/07/2013
Work Activity: Driving Safety		
Personal Protective Equipment (PPE): Safety glasses with side-shields, high visibility vest, steel toed boots.		

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Perform perimeter walk around vehicle checking for: • Tire condition (air pressure, tread, sidewall integrity, rims) • Window/Windshield cleanliness • Wiper damage • Mirrors • Lights functioning • Fluid leaks • Obstructions behind vehicle • Unusual conditions	**1.** **CB/SA** Vehicle traffic or obstructions **2.** Low air pressure or flat tire **3.** Tire blow out **4.** Impaired vision **5.** Collision	**1a.** Be aware of surroundings at all times • Have vehicle parked in a safe, quiet area **2a.** Assure tires are properly inflated and there is sufficient tread (including spare). **3a.** Check that there are no cuts or bulges in sidewalls • Check rims are in good condition **4a.** Assure windshield and window glass is clean and free from obstructions • Lift wiper arms and check wiper blades for damage • Check to see that all lights work **5a.** Check for fluid leaks under vehicle • Check behind vehicle for obstructions	**1b.** Vehicle is parked in a busy and dangerous area, not safe to walk around. **2b.** Tires have low air pressure and/or are flat. • There is no tread on tires, obvious wear areas **3b.** Gouges or bulges are located in sidewall of tire. • Rims are damaged. **4b.** Windshield and/or windows are obstructed • Wipers are damaged • Lights are not functioning **5b.** Vehicle is leaking fluid • Obstructions are present behind vehicle

1 – Target number of job steps: six to ten
2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Elimination, Engineering Controls, Safe Work Practice / SOP, Administrative Controls, and/or PPE.
4 – Stop Work Trigger: Condition or situation that would require work to be stopped and hazards re-assessed.

Job Safety Analysis

JSA Type: ☒ Investigation ☒ O&M ☐ Office ☒ Construction ☐ Other	☐ New ☒ Revised	Date: 3/07/2013
Work Activity: Driving Safety		
Personal Protective Equipment (PPE): Safety glasses with side-shields, high visibility vest, steel toed boots.		

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Make adjustments inside the vehicle, including: • Seat • Steering wheel • Headrest • Mirrors Check to see that driver controls are working properly, including: • Headlamps • Turn signals • Backup lights • Hazard lights • Washer/wipers	**1.** Back or body strain.	**1a.** Adjust seat, steering wheel height and headrest so body is fully supported, upper arms close to body, pedals within easy reach. • Lower steering wheel so hands are below shoulders and shoulders are relaxed. **1b.** Check mirror adjustments each time vehicle is re-started. **1c.** Test operations of headlights, front and rear turn signals, backup lights. **1d.** Locate and test operation of wiper and washer switches.	**1a.** Seat and steering wheel can not be adjusted to provide support or allow access to pedals/good visibility. **1b.** Mirrors are damaged or missing and can not be adjusted. **1c.** Lights are not working or malfunctioning **1d.** Wipers are not working or malfunctioning.
Start engine. Check gauges and warning lights while engine is warming up.	**1.** Unexpected movement. **2.** Overheated engine or breakdown due to lack of critical fluids.	**1a.** Assure that transmission is in 'Park' and that parking brake is set. **2/3a.** Assure there is sufficient gas, oil, and other critical fluids, by checking warning lights. • Check maintenance record of vehicle for last oil change and servicing • Turn on headlights.	**1/3b.** Transmission is malfunctioning and vehicle is unable to be put in park.

1 – Target number of job steps: six to ten
2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Administrative Controls, Engineering Controls, PPE, and/or Safe Work Practice / SOP

Job Safety Analysis

JSA Type: ☒ Investigation ☒ O&M ☐Office ☒ Construction ☐ Other	☐ New ☒ Revised	**Date**: 3/07/2013
Work Activity: Driving Safety		
Personal Protective Equipment (PPE): Safety glasses with side-shields, high visibility vest, steel toed boots.		

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Drive Vehicle	**1.** Collision with traffic or obstructions. **2.** Ejection from vehicle in collision.	**1a.** Look behind the vehicle before backing up **1b.** Maintain posted speed limits **1c.** Right of way given to heavy equipment and larger vehicles. **1d.** No use of cellular phones when driving **2a.** Assure seat belt is in good condition and fastened. • Assure all passenger seat belts are in good condition, fastened and working. • Turn on passenger air bag if necessary.	**1a.** Obstructions in the vehicles intended path **2a.** Any passenger not wearing a seatbelt.
Park Vehicle on Site	**1.** Vehicle becoming an obstruction **2.** Adverse effects of the exhaust on air monitors (if applicable) **3.** Unexpected movement	**1.** Be aware of typical traffic routes on site and park out of the way **2.** Look to see where air monitors are located (if applicable) and park at least 50 feet downwind of them **3.** Place vehicle in park and deploy the parking break	**1.** Unable to park out of the way of site traffic **2.** Unable to park downwind and away from air monitors (if applicable)

1 – Target number of job steps: six to ten
2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Administrative Controls, Engineering Controls, PPE, and/or Safe Work Practice / SOP

Job Safety Analysis - Groundwater Sampling (Low Flow)

JSA Type: ☒ Investigation ☐ O&M ☐Office ☐ Construction ☐ Other:	☒ New ☐ Revised	**Date**: 03/07/13
Developed By: Robert McKeever	**Reviewed By:**	
Is this JSA an attachment to a Safe Work Plan: ☒ Yes, Mt. Vernon HASP ☐ No		

Work Activity: Groundwater Sampling

Personal Protective Equipment (PPE):

☒ Hard Hat	☒ Safety Glasses	☐ Ear Muffs	☐ Long Pants/Sleeves	☒ Inner Glove	☐ Fall Protection	☐ Wide Brim Hat
☒ Leather Glove	☐ Safety Goggles	☐ Ear Plugs	☐ Coveralls (coated)	☒ Outer Glove	☐ Cooling Vest	☐ Half/Full Face Respirator
☐ Kevlar Glove	☒ Safety Toe Boots	☒ Traffic Vest	☐ Flame Resistant Clothing	☐ Face Shield	☐ Welding PPE	☐ Cartridge/Filter Type:

Other PPE:

Safety Equipment:

☒ First Aid Kit	☐ Eyewash Station	☒ Eyewash Bottles	☐ Fire Extinguisher (A-B-C)	☐ Pop-up Shade	☒ Sunscreen	☒ Drinking Water
☐ Air Horn	☐ Trekking Poles	☒ Insect Repellent	☐ Wheel Chocks	☐ Cargo Net	☐ Stretch First Safety First	

Other Safety Equipment:

AECOM SH&E Standard Operating Procedures (SOP)s:

001 Safe Work Standards and Rules,
002 Stop Work Authority for Unsafe Work
005 Vehicle and Driver Safety Program
206 Fire Protection Field
210 Project Safety Meetings
302 Electrical General
305 Hand and Power Tools
307 Housekeeping Worksite
308 Manual Lifting Field

Risk Level Calculation - Select Risk Level for each job step, prior to controls

Severity	
1	Remote potential for injury, property damage/$ loss, or env damage
2	Potential for minor first aid injury, property damage/$ loss, or environmental damage
3	Potential for moderate personnel injuries (medical treatment), property damage/$ loss, environmental damage, or negative public impact
4	Potential for a serious injury, major property damage/$ loss, serious impact to the environment, and public health
5	Catastrophic damage to people, property/equipment, environment, or public health

Likelihood	
1	Very unlikely
2	Unlikely
3	Likely
4	Very likely
5	Certain

Likelihood \ Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Level (RL)
Low (1-4)
Medium (5-15)
High (16-25)

Principal Steps	Potential Hazards	Recommended Controls	RL
Conduct tailgate safety meeting and site walk (reconnaissance).	• Biologic hazards such as insects, poison ivy, spiders, and snakes. • Damage to equipment or vehicles due to surface/subsurface obstructions. • Slips, trips, falls. • Dehydration. • Moving vehicles	• Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary. Use snake chaps or shin guards. Use a bar to clear out objects and/or vegetation from spiders and/or snakes (do not use your hands or feet). • Inspect area before driving and/or walking. • Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. • Contact site manager immediately and do not proceed if any conditions are observed that could make driving/walk in the area unsafe and that cannot be fixed with the equipment or personnel onsite. • Use this opportunity to begin hydrating yourself. Being thirsty is a sign of dehydration (warning you that you are already dehydrated). Monitor urine output (frequency and color).	

AECOM Job Safety Analysis - Groundwater Sampling (Low Flow)

		• Inspection location of meeting for visibility to drivers and equipment operators, move location to a more visible area as needed, use cones and other visual warnings to alert drivers and equipment operators.	
Driving and/or walking to well locations.	• Moving equipment (forklifts, machinery, cranes) • Slip trip and falls, uneven ground • Storage of materials at heights (distribution materials) • Lifting/Carrying supplies (back strain) • Reaching and body position • Traffic exposure	• Inspect your surroundings, identify potions trip, slip fall hazards • Indentify the driving lanes for equipment and vehicles • If you need to look at paperwork, takes notes or photos, have the site contact be a look-out. • Visually inspect the integrity of material storage to make sure nothing has the potential to fall from above. • Carry loads that are not too heavy for you (<49), park as close to well location to reduce walking and carrying distance • Position vehicle to protect from oncoming traffic, and to minimize reaching distances for supplies.	
Opening Well Casings/Flush-mount Covers	• Pinch points. • Biological hazards. • Cuts/lacerations. • Chemical Exposure	• Identify pinch points before beginning any task. If possible, use hand safety stickers or other visual means to remind everyone that may come into contact with the equipment where pinch points are located. Inspect all guards to ensure they are present and working. Never remove guards. • Check immediate area for potential hazards such as poison ivy, spiders, wasps, snakes, etc. Use bug repellent and sunscreen as necessary. Use snake chaps or shin guards. Use a bar to clear out objects and/or vegetation from spiders and/or snakes (do not use your hands or feet). • Use leather gloves over your nitrile gloves when opening well casings to help grip and prevent cuts or slips on the casing. Use a lubricant such as WD-40 to help opening rusted locks – do not use a hammer to break the lock open. If necessary, use bolt cutters to open a lock • Stand upwind from well when opening, use air monitoring equipment, open slowly	
Gauging static water level.	• Contaminants. • Pinch points. • Injuries caused by improper lifting techniques. • Repetitive Motions • Blisters and Hand Injuries	• Always wear nitrile gloves when handling equipment that comes into contact with groundwater. Double glove if you know you are prone to glove breakage. • Use air monitoring equipment, and follow action levels • Stay upwind of chemical sources. • Identify pinch points before beginning any task. If possible, use hand safety stickers or other visual means to remind everyone that may come into contact with the equipment where pinch points are located. Inspect all guards to ensure they are present and working. Never remove guards. • Use proper bending/lifting techniques by bending and lifting with legs and not with back. • Avoid repetitive motions, change position frequently, take breaks, stretch, switch tasks and use a partner. • Inspect gloves for seams, tags etc which may cause a blister, wear leather gloves over/under chemical gloves to prevent blisters.	
Decontaminating water level meter or interface probe.	• Cross contamination. • Contaminants.	• Triple rinse using distilled or deionized water and alconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination. • Always wear nitrile gloves when handling equipment. Double glove if you know you are prone to glove breakage. • Use air monitoring equipment, and follow action levels • Stay upwind of chemical sources	
Set up low-flow equipment at each well site.	• Sharp materials. • Pinch points. • Injuries caused by improper lifting techniques. • Slips, trips, and falls.	• Wear leather or kevlar gloves to avoid sharp edges. • Use the proper hand tools that are ergonomically designed with safety guards in place as appropriate. • Identify pinch points before beginning any task. If possible, use hand safety stickers or other visual means to remind everyone that may come into contact with the equipment where pinch	

AECOM Job Safety Analysis - Groundwater Sampling (Low Flow)

	• Spark hazard or electric shock (battery use) • Handling equipment.	points are located. Inspect all guards to ensure they are present and working. Never remove guards. • Use proper bending/lifting techniques by bending and lifting with legs and not with back. • Inspect area before walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make walking in the area unsafe and that cannot be fixed with the equipment or personnel onsite. • Always place the battery source in a dry safe place on level ground. Do not touch the terminals of the battery except with the appropriate equipment. Do not connect positive to negative and vice versa. • Be familiar with all equipment before use. Use good care of all equipment, do not drop or shake it. Use security tethers when available.	
Lower tubing and submersible pump down well casing. - may also use bailers and surge blocks.	• Contaminants. • Cuts or lacerations. • Injuries caused by improper lifting techniques. • Siphon action.	• Always wear nitrile gloves when handling equipment. Double glove if you know you are prone to glove breakage. • Use air monitoring equipment, and follow action levels • Stay upwind of chemical sources. • Use the proper hand tools that are ergonomically designed with safety guards in place as appropriate. • Use proper bending/lifting techniques by bending and lifting with legs and not with back. • Eliminate siphon action by attaching purge tubing above expected high water line in bucket or drum.	
Turn on equipment.	• Electric shock, (battery use)	• Always place the battery source in a dry safe place on level ground. • Do not touch the terminals of the battery except with the appropriate equipment. • Do not connect positive to negative and vice versa.	
Develop water from well casing	• Contaminants. • Spills.	• Always wear nitrile gloves when handling equipment. Double glove if you know you are prone to glove breakage. • Use air monitoring equipment, and follow action levels • Stay upwind of chemical sources. • Place buckets or drums on a level surface to avoid potential for the bucket to tip over. Secure tubing in bucket or drum to prevent spills.	
Breakdown and decontaminate equipment.	• Contaminants. • Cuts and lacerations. • Cross contamination • Pinch points • Striking others.	• Always wear nitrile gloves when handling equipment. Double glove if you know you are prone to glove breakage. • Stand upwind from well when opening, use air monitoring equipment, open slowly • Use leather or kevlar gloves over your nitrile gloves to breakdown equipment to help grip and prevent cuts or slips on the equipment. • Triple rinse using distilled or deionized water and alconox for first rinse and distilled or deionized water for second and third rinses. Always clean materials between locations and at the site. Do not bring equipment back to the office without proper decontamination. • When disconnecting cords or tubing from equipment, be aware that it may be difficult to twist off. When possible, ask for assistance. Wear leather gloves to help protect your hands. • Before disassembling tools, look around and ensure proper clearance. Identify and communicate to other workers within striking distance.	
Secure equipment in vehicle.	• Damage to equipment/tools and/or accidents with loose objects. • Pinch points.	• Stow all materials in vehicle properly, use appropriate cases and bags. • Secure equipment in bed of truck with netting or straps. Do not leave any equipment loose in the cab or bed or the truck. It can cause property damage or serious injuries to others or yourself by falling-off from vehicle. • When securing equipment, watch for pinch points. Straps and netting can get caught on objects and snap back as well as trap a finger if hand placement is not correct. Use a buddy to	

AECOM Job Safety Analysis - Groundwater Sampling (Low Flow)

		help secure equipment when possible.	
Transport purge water to disposal container/area	• Spills. • Pinch points. • Damage to equipment or vehicles due to surface/subsurface obstructions. • Slips, trips, falls. • Fixed facilities	• Secure buckets filled with purge water in bed of truck. Do not overfill buckets. Secure lid on buckets. If necessary, place buckets in secondary containment when transporting. • When snapping lid on buckets, wear leather gloves to protect your hands. Use lids designed for that particular bucket. • Inspect area before driving and/or walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make driving/walk in the area unsafe and that cannot be fixed with the equipment or personnel onsite. • When parked near a fixed facility (building, monitoring well, bollards, etc…) evaluate and plan route prior to mobilization. Use the buddy system/spotter when backing-up vehicle.	
Set up fluid transfer equipment at disposal container/area.	• Sharp materials. • Pinch points. • Injuries caused by improper lifting techniques. • Slips, trips, and falls. • Spark hazard or electric shock • Handling equipment.	• Wear leather gloves to avoid sharp edges. Use the proper hand tools that are ergonomically designed with safety guards in place as appropriate. • Use SPSA to help identify pinch points before beginning any task. If possible, use hand safety stickers to remind everyone that may come into contact with the equipment where pinch points are located. • Use proper bending/lifting techniques by bending and lifting with legs and not with back. • Inspect area before walking. Identify possible hazards such as holes, obstructions protruding from the ground, or debris that may be scattered on the ground. Contact site manager immediately and do not proceed if any conditions are observed that could make walking in the area unsafe and that cannot be fixed with the equipment or personnel onsite. • Always place the battery source in a dry safe place on level ground. Do not touch the terminals of the battery except with the appropriate equipment. Do not connect positive to negative and vice versa. • Be familiar with all equipment before use. Use good care of all equipment, do not drop or shake it. Use security tethers when available.	

Inspection Requirements	**Training and Qualification Requirements**
Work area	Hazwoper 40 hour, 8 hour refresher, medical exam
Hand tools, equipment, containers	Site specific HASP
	Respiratory protection fit test and medical exam
	Hazard Communication – MSDS Review

Air Monitoring Requirements ☐ Not Applicable

Parameter	**Monitoring Zone/Location**	**Action Level**	**Action**
VOC (Total by PID)	Breathing Zone/ Work Area	< 5 PID Units, sustained 5 mins > 5 PID Units, sustained 15 mins	• Continue work in required PPE and continue monitoring. • **Stop Work!**, exit, and contact the SH&E Professional and Project Manager.

Job Safety Analysis - Groundwater Sampling (Low Flow)

Printed Name	Signed Name	Company	Date

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐Office ☒ Construction ☐ Other	☒ New ☐ Revised	**Date**: 03/07/2013
Work Activity: Oversight and System Connection		
Personal Protective Equipment (PPE): Safety glasses with side-shields, high-visibility vest, hard hat, steel-toed boots, work gloves.		

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Conduct H&S meeting, set up exclusion zone	**CW** Traffic or Excavation Machinery	• Periodically assess your surroundings for hazards • Wear appropriate PPE for active construction sites (i.e. Safety vest)	• Someone enters exclusion zone without proper PPE • Unsafe activity in close proximity
Trenching Oversight	**CB/SB** hand tools or construction machinery (if not hand dug) **CBT** moving parts of construction machinery (if not hand dug) **FB** if soil stability is jeopardized **E** to contaminated soil, ambient dust or dangerous gases.	• Direct visual contact is obtained between operator and oversight personnel. • Use care when walking near the edge of the trench • Competent person (per OSHA definition) supervises the trenching at all times. • Install proper engineering controls to maintain stability of sidewalls. • Suppress dust with water mist. • Continuously check air monitoring equipment	• Direct visual contact cannot be obtained or maintained. • Safe pathway can not be obtained • Soil or slope stability is not achieved or can not be maintained. • Ambient dust is observed or dust level is triggered. • Monitoring equipment not working properly

1 – Target number of job steps: six to ten
2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Elimination, Engineering Controls, Safe Work Practice / SOP, Administrative Controls, and/or PPE.
4 – Stop Work Trigger: Condition or situation that would require work to be stopped and hazards re-assessed.

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐Office ☒ Construction ☐ Other	☒ New ☐ Revised	**Date**: 03/07/2013
Work Activity: Oversight and System Connection		
Personal Protective Equipment (PPE): Safety glasses with side-shields, high-visibility vest, hard hat, steel-toed boots, work gloves.		

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Oversight of Piping Install and Backfill	**CB/SB** hand tools or construction machinery (if not done by hand) **CBT** moving parts of construction machinery (if not done by hand) **E** to solvent fumes, contaminated soil, ambient dust or dangerous gases.	• Direct visual path is obtained between all operators and oversight personnel. • Use care when walking near the edge of the trench • Suppress dust with water mist. • Continuously check air monitoring equipment • Ensure adequate ventilation during pipe priming/gluing activities	• A direct visual path cannot be obtained. • Safe pathway can not be obtained • Ambient dust is observed or dust level is triggered. • Monitoring equipment not working properly • Adequate ventilation not achievable
Concrete Pad Installation Oversight	**CB/SB** construction machinery **CBT** moving parts of construction machinery.	• Direct visual path is obtained between all operators and oversight personnel. • Ensure all persons are clear of forming area during concrete pour	• A direct visual path cannot be obtained. • Area not clear during concrete pour

1 – Target number of job steps: six to ten
2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Administrative Controls, Engineering Controls, PPE, and/or Safe Work Practice / SOP

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐Office ☒ Construction ☐ Other	☒ New ☐ Revised	**Date**: 03/07/2013

Work Activity: Oversight and System Connection

Personal Protective Equipment (PPE): Safety glasses with side-shields, high-visibility vest, hard hat, steel-toed boots, work gloves.

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
System (Shed) Delivery and Offloading Oversight	**CB/SB** construction machinery or deliverable (shed) **CBT** moving parts of construction machinery or concrete pad and deliverable.	• Clearly mark out footprint of deliverable (shed) final resting place and discuss with operator • Inspect all rigging (if applicable) prior to permitting hoisting of the equipment • Direct visual path is obtained between all operators and oversight personnel. • Ensure all persons are clear of pad area during delivery	• Area not clearly marked out • Rigging compromised in any way • A direct visual path cannot be obtained. • Area not clear during delivery
Making Final System Connection from Stub-ups to Exterior of System Enclosure	**CB/SB** hand tools **CBT** connection points while performing hose installation **O** caused by improper bending/lifting techniques	• Wear proper PPE and ensure all hand tools are in good working order • Be aware of pinch points • Implement proper bending/lifting techniques	• Hand tools are not in good working order • Any portion of body/clothing gets pinched • Any discomfort is encountered while performing work

1 – Target number of job steps: six to ten

2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Administrative Controls, Engineering Controls, PPE, and/or Safe Work Practice / SOP

Job Safety Analysis

JSA Type: ☐ Investigation ☐ O&M ☐Office ☒ Construction ☐ Other	☒ New ☐ Revised	**Date**: 03/07/2013

Work Activity: Oversight and System Connection

Personal Protective Equipment (PPE): Safety glasses with side-shields, high-visibility vest, hard hat, steel-toed boots, work gloves.

Development Team	Position/Title	Reviewed By	Position/Title	Date
Robert McKeever	Project Engineer			

❶ Job Steps[1]	❷ Potential Hazards[2]	❸ Critical Actions[3]	STOP Stop Work Criteria
Installing ISOC Units Within Appropriate Wells	**FS** while mobilizing ISOC units to wells **CB/SB** hand tools **CBT** connection points while connecting ISOC unit to hose **CBT** well and ISOC unit during installation **O** caused by improper bending/lifting techniques	• Be aware of surroundings and clear area around well before commencing work • Wear proper PPE and ensure all hand tools are in good working order • Be aware of pinch points • Implement proper bending/lifting techniques	• A clear area cannot be established • Hand tools are not in good working order • Any portion of body/clothing gets pinched • Any discomfort is encountered while performing work

1 – Target number of job steps: six to ten

2 – Codes for Potential Hazards:

Caught Between (CBT)	Contacted By (CB)	Caught On (CO)	Fall To Below (FB)	Overexertion (O)	Struck Against (SA)
Caught In (CI)	Contact With (CW)	Exposure (E)	Fall - Same Level (FS)	Release To (R)	Struck By (SB)

3 – Types of Critical Actions: Administrative Controls, Engineering Controls, PPE, and/or Safe Work Practice / SOP

ATTACHMENT C

Pre-Entry Briefing Attendance Sheet

HEALTH AND SAFETY PLAN PRE-ENTRY BRIEFING ATTENDANCE FORM

Environmental Oversight of Remedy Implementation

National Fuel Gas Distribution Company

Briefing Conducted By: _____

Date Performed: _____

Topics Discussed including work to be performed today:

_____

_____

_____

_____

Printed Name	Signature	Representing

ATTACHMENT D

Safety & Health Environmental Procedures

SH&E No. 110 – Ergonomics Program

SH&E No. 113 – Hearing Conservation Program

SH&E No. 114 – Respiratory Protection Program

SH&E No. 115 – Personal Protective Equipment Program National Fuel Gas's CEHSP S05.03 is the controlling procedure for PPE use.

SH&E No. 306 – Working Alone

SH&E No. 308 – Manual Lifting, Field

SH&E No. 309 – Mobile or Heavy Equipment

SH&E No. 310 – Rigging, Hoisting, Cranes and Lifting Devices

SH&E No. 406 – Electrical Lines, Overhead

SH&E No. 410 – Hazardous Energy Control (Lockout/Tagout) National Fuel Gas's CEHSP S12.00 is the controlling procedure for LO/TO procedures.

SH&E No. 506 – Compressed Gases

SH&E No. 601 – General Electrical Safety

SH&E No. 602 – Elevated Work Platforms

SH&E No. 605 – Fall Protection

SH&E No. 607 – Manual Lifting

SH&E No. 705 – Highway and Roadwork

SH&E No. 713 – Confined Spaces

SH&E No. 714 – Excavation & Trenching

SH&E No. 726 – Identifying Underground Installations

AECOM Ergonomics Program **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	110
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Establishes AECOM's Ergonomic Program to identify and reduce the risk associated with musculoskeletal injury to its employees.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

MSD - Musculoskeletal disorder

Regional Operations Manager – The person assigned overall management and budgetary authority for a defined business unit or office.

Supervisor – Personnel other than Managers who exercise management authority (with or without budgetary responsibility) of office personnel and work activities.

Ergonomics Specialist – SH&E representative or designee knowledgeable in ergonomics and application of its principles in the workplace.

Job-Specific MSD Hazard – Any type of condition that is known to be associated with performance of a particular job or work duty and that may result in a musculoskeletal disorder.

4.0 ROLES AND RESPONSIBILITIES

4.1 EMPLOYEES

All AECOM employees must:

- Familiarize themselves with the potential job-specific MSD hazards associated with their assigned job (review SH&E-supplied training information).
- Organize their work station in accordance with sound ergonomic practices.
- Properly utilize any MSD hazard control equipment/devices that have been provided for use.
- Observe sound ergonomic practices in their work procedures.
- Identify to their Manager/Workplace Supervisor possible MSDs they experience for review by SH&E.
- Notify supervisors of ergonomic issues at their work stations.

4.2 DISTRICT/OFFICE MANAGERS AND PROGRAM MANAGER (FIELD TASK MANAGERS/ SUPERVISOR)

The Operations Office Manager and Project Manager (PM) have overall responsibility for ergonomics within their facility(ies). Managers (and supervisors) will:

- Provide personnel with access to information concerning MSD hazards and available mitigation methods associated with their assigned job.

- Provide personnel with access to protective equipment and procedures appropriate to the worker's job (as recommended by the SH&E Department).
- Provide notification to the SH&E Department in the event of worker complaints/reports, which may be related to a job-specific MSD hazard.
- Promptly respond to any identified MSDs as recommended by the SH&E Department.
- Facilitate work station self-assessments by employees within two weeks of hire.
- Coordinate the ergonomic review/inspection of employee work stations by a Regional SH&E Manager.
- Coordinate with Regional SH&E Managers on office relocations and build-outs to facilitate the design of appropriate facilities and the acquisition of appropriate office equipment that impact ergonomic aspects of a work area.
- Coordinate with Regional SH&E Managers on replacement of office equipment that impact ergonomic aspects of a work area.

4.3 SH&E DEPARTMENT

The SH&E Department has responsibility for providing technical support to Region, District and Office Managers and Project Managers in the identification and management of ergonomics hazards and administering ergonomics investigation/evaluation procedures.

The SH&E Department will include ergonomics aspects in office evaluations.

5.0 PROCEDURE

AECOM will maintain an Ergonomic Program consisting of the following elements:

5.1 EMPLOYEE TRAINING

The SH&E Department will develop an ergonomics training program to include:

- General and job-specific MSD hazards associated with the types of work activities performed in AECOM offices/facilities;
- Specific hazards or trends that have been identified;
- Good ergonomic work practices that employees should incorporate; and,
- Discussion of the work station evaluation process.

5.2 EMPLOYEE MEDICAL MONITORING AND SUPPORT

MSDs will be treated in a manner similar to other workplace incidents (SH&E SOP 201 – *Incident Reporting* and SOP 204 – *Incident Investigation*). The following reporting and evaluation procedure will be implemented for any employee who feels he/she is experiencing a work-related MSD. This includes anyone who is experiencing pain/discomfort during the performance of office work, or anyone with a work-related MSD injury diagnosed by a physician or other competent medical authority.

- The employee must notify his/her Manager or Supervisor immediately.
- The Manager or Supervisor will notify the Regional SH&E Manager, who will initiate a work station evaluation.
- If necessary, the Regional SH&E Manager will coordinate a medical evaluation of the affected employee.
- Using the available medical data and results of the ergonomics evaluation, the Regional SH&E Manager will provide the local Manager or Supervisor with recommendations to mitigate the identified MSD hazards.

5.3 WORKPLACE EVALUATIONS

The Regional SH&E Manager will coordinate a work station ergonomics evaluation in response to any of the following:

- Any notice from an employee or supervisor following a new hire work station self assessment.
- Employee diagnosed with a work-related MSD – evaluate the employee's work station to determine specific improvements.
- Multiple diagnosed MSDs in a single job category (i.e., graphics designer; administrative assistant; AutoCAD operator) – evaluate representative work stations office-wide to determine appropriate job-specific guidance.
- Request from worker/supervisor or employee – evaluate the specific work station(s) and provide recommended improvements.

Results of all evaluations will be prepared in written form, and will be maintained by the SH&E Department (as outlined in Section 5.5 below).

5.4 SPECIFICATION OF CONTROL EQUIPMENT

If a job-specific MSD hazard is identified (two or more similar MSDs have been reported for a specific job category within a regulatory-specified time period), the Regional SH&E Manager will facilitate an evaluation of typical workstations related to the respective job category. Results of this evaluation will be used to develop a list of job-specific ergonomic practices and/or required control equipment to be implemented. Once these are established, Operations Managers will implement appropriate measures in a timely manner.

5.5 RECORDS

The SH&E Department will maintain the following Ergonomic Program records:

- Individual employee work station evaluations and job-type work station evaluations.
- Employee/supervisor reports of ergonomic hazards and follow-up.
- Training records.

6.0 REFERENCE MATERIAL

- SH&E SOP 201 – *Incident Reporting*
- SH&E SOP 204 – *Incident Investigation*

7.0 ATTACHMENTS

- None

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

AECOM Hearing Conservation Program **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	113
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Establishes procedures to ensure personal noise exposure remains within acceptable limits and establishes the requirements of an acceptable hearing conservation program.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Decibel (dB) - Unit of measurement of sound level.

Action Level - An eight-hour time-weighted average of 85 decibels measured on the A-scale, slow response, or equivalently; a dose of 50 percent.

Standard Threshold Shift (STS) – When one's hearing threshold has changed (relative to the baseline audiogram) an average of 10 dB or more at 2000, 3000, or 4000 Hz in either ear.

Noise Reduction Rating (NRR) - The measure, in decibels, of how well a hearing protector reduces noise, as specified by the Environmental Protection Agency.

4.0 ROLES AND RESPONSIBILITIES

4.1 REGIONAL SH&E MANAGERS

- Provide initial and annual hearing conservation training
- Inform employees of noise monitoring results when full-shift noise exposure is at or above the action level
- Designate areas and tasks where employees' exposure is at or above the action level
- Conduct noise monitoring, as applicable, and support hazardous noise assessment/evaluation efforts

4.2 PROJECT MANAGERS (FIELD TASK MANAGERS)

- Implement the hearing conservation program
- Ensure that a hazardous noise assessment/evaluation has been conducted
- Ensure that a hazardous noise assessment/evaluation is conducted when a change in equipment, procedures or personnel may increase employee exposure to noise
- Implement engineering controls to reduce noise levels when such measures are considered feasible and required by regulation
- Purchase, monitor and replenish supply of hearing protection devices, with a minimum Noise Reduction Rating (NRR) of 26 dBA, for employees
- Ensure individuals included in the program receive training and that the training meets the criteria outlined in this program

- Investigate and implement corrective action to all reports of non-conformance with this procedure including reports of standard threshold shifts or employees' failure to wear hearing protectors in designated areas

4.3 SUPERVISORS

- Maintain an awareness of the noise levels in work areas for which he/she is responsible
- Place warning signs in areas where sound levels would require the use of hearing protectors
- Request a hazardous noise assessment/evaluation be conducted when a change in equipment, procedures or personnel may increase employee exposure to noise
- Ensure that all employees are aware of the requirements for hearing protection for any designated area or task
- Enforce the use of hearing protection by employees in designated areas and for designated tasks

4.4 EMPLOYEES

- Comply with the requirements of the Hearing Conservation program
- Inspect and maintain hearing protection devices
- Wear hearing protection devices in designated areas or for designated tasks
- Report any suspected change in noise levels of work area to supervisor
- Report any signs or symptoms experienced that could be the result of overexposure to noise to supervisor
- Participate in audiometric testing and hearing protection training when required

5.0 PROCEDURE

The requirements of this procedure apply to all locations/facilities/projects where employee noise exposure may equal or exceed 50 percent of the allowable noise dose or Permissible Exposure Limit (PEL). Table 1 provides information relative to the current PEL for noise exposure expressed as a time-weighted average.

Table 1. Permissible Exposure Limit

SOUND LEVEL (dBA)	TIME (hours)
85	16
90	8
95	4
100	2
105	1
110	0.5
115	0.25

Table 2 provides information relative to the Action Level (or 50 percent allowable noise dose) expressed as a time-weighted average. The action levels outlined in the table below, and PELs described in Table 1, are calculated without regard to the protection afforded by the use of hearing protectors.

Table 2. Action Levels for Hearing Conservation Program

SOUND LEVEL (dBA)	TIME (hours)
85	8

90	4
95	2
100	1
105	0.5
110	0.25
115	0.125

Any project or facility location where an employee may be exposed to noise at or above the action level shall develop a written hearing conservation program that meets the requirements of this general program and all applicable state-specific regulations. Attachment 1 provides a template for use in developing these written programs.

5.1 AUDIOMETRIC TESTING

- All AECOM personnel with potential exposure greater than the action level (noise dose equivalent to an eight-hour, time-weighted average noise exposure at or above 85-dBA) will be enrolled in the medical surveillance program and undergo a baseline audiogram. Thereafter, annual audiograms will be compared with the baseline exam.
- When a Standard Threshold Shift (STS), as identified by the AECOM Medical Consultant, is noted between the last valid baseline and the annual audiogram, the following steps will be taken:
  - A retest will be conducted within 30 days to confirm the STS. The employee will not be exposed to workplace/hobby noise for 14 hours or will be provided with adequate hearing protection prior to testing.
  - If the STS persists, ear protection will be upgraded to one with a greater NRR. The minimum NRR will be 26 dBA.
  - The employee will be counseled and AECOM will obtain information regarding the employee's possible noise exposure away from the workplace or existing ear pathology.
  - Qualified medical personnel will review the audiograms. This group will determine the need for a medical referral.
  - The employee will be notified in writing by either the SH&E Department or the AECOM Medical Provider of the STS, within 21 days of determination, as required by OSHA.
  - The employee's supervisor will be notified of the shift in hearing threshold.
  - If the employee who has experienced an STS is exposed to 85 dBA for eight hours or 80 dBA for 12 hours, mandatory use of ear protection is required.
  - Temporary employees will receive audiograms during their exit physicals if they have worked around heavy equipment or have received an exposure to noise levels in excess of 85 dBA.

5.1.1 Monitoring of Noise Levels

As deemed necessary by an SH&E Professional, AECOM will periodically monitor personal and area noise levels using noise dosimetry and/or sound level meters.

5.2 HEARING PROTECTORS

Selection of appropriate hearing protectors must be based on actual or anticipated exposure levels. At a minimum, hearing protectors must provide a level of protection that brings actual or anticipated exposure below the PEL established for the time period shown in the table above. Additional information relative to hearing protector use is as follows:

- Hearing protection will be mandatory for all employees exposed above a sound level for any period of time in excess of that listed in the table above.
- Hearing protection will be mandatory for all employees working in any area that has not been evaluated for noise exposure and the ambient noise level in the area is such that you must raise your voice to have a normal conversation with someone less than five feet from you and/or when within 25 feet of an operating piece of heavy equipment.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for eight hours and 80 dBA for 12 hours.
- Hearing protection will be mandatory for all employees who work on or near heavy equipment unless personal dosimetry or other techniques have been used to document actual exposure.
- Hearing protectors will be made available to all employees exposed to 85 dBA for eight hours or more.
- Hearing protection will be mandatory for all employees exposed to 85 dBA for any period of time and who have experienced an STS.
- The SH&E Department will approve all hearing protection devices. All employees will be trained in the proper use, care, and maintenance of the protectors.

5.3 RECORDS RETENTION

- Noise exposure measurement records will be retained for three years at the project/facility
- Audiogram records will be retained in the employee's medical records per SH&E SOP 401, *Medical Surveillance* for a period as directed by AECOM's Medical Provider
- Annual employee training session documentation will be retained for the duration of employment.

5.4 TRAINING PROGRAM

All employees with potential exposure above the action levels established in Section 2.0 of this procedure, or who otherwise utilize any type of hearing protector, will participate in an annual training program.

5.4.1 Training Objectives

The initial and subsequent annual hearing conservation training will address, at a minimum, the following topics:

- The effects of noise on hearing, recognizing hazardous noise and symptoms of overexposure to hazardous noise
- When and/or where hearing protectors are required to be worn
- The purpose of hearing protectors
- The advantages, disadvantages and effectiveness of various types of protectors
- Instructions on how to select, use, fit and care for hearing protectors
- The purpose of audiometric testing, including an explanation of the test procedures
- Hearing Conservation Program requirements and responsibilities

Hearing protection training is conducted annually for all affected employees, or more frequently for employees who do not properly use hearing protectors or otherwise fail to comply with this policy.

6.0 REFERENCE MATERIAL

Title 29 CFR Part 1910.95 Noise Protection

SH&E SOP 401 - *Medical Surveillance Program*

7.0 ATTACHMENTS

Attachment 1 – Site-Specific Hearing Conservation Program Template

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

Site-Specific Hearing Conservation Program
_____ Site

1.0 Monitoring

As per 29 CFR 1910.95, noise monitoring will be conduct by:

_____

Such monitoring will consist of (*check those that apply*):

☐ Noise Dosimetry ☐ Sound Level Meter Survey

Specific instrumentation to be used is (Make/Model):

Make	Model

and will be calibrated at a frequency of _____ and documented in the _____.

Monitoring strategy is as follows: (*List all equipment and activities on site which may involve sound pressure levels above 80 dBA and an explanation of the strategy to document actual exposures*).

Area/Equipment	Monitoring Strategy

All monitoring will be documented utilizing the format illustrated following Section 7.0 (*attach form developed for the specific site*). These forms will be maintained in accordance with Section 7.0 of this program. Monitoring frequency will be in accordance with the strategy outlined above and when the following changes in site conditions/activities occur:

1.
2.
3.
4.
5.

2.0 Employee Notification

All site employees exposed above the OSHA action level (85 dBA – 8 hour TWA) will be notified of the monitoring results by (*insert Name/Title*) _____ at an interval not to exceed _____ after completion of monitoring.

Notification shall be written with copy to SH&E Department. Documentation of employee notifications and corresponding signatures of notified employees will be kept in the health and safety logbook/files.

3.0 Observation of Monitoring

All employees affected by the monitoring, or a designated employee representative, shall be given the opportunity to observe noise monitoring procedures. This will be achieved by:

4.0 Audiometric Testing Program and Requirements

AECOM personnel who perform field activities where noise exposure above action levels is expected are required to participate in an audiometric testing program meeting the requirements of OSHA 29 CFR 1910.95. Additionally, any subcontractors performing work on AECOM projects where noise levels exceeding action level will be required to provide documentation that they participate in an audiometric testing program which meets the requirements of 29 CFR 1910.95. Documentation of participation in the testing program will be maintained by _____ and will be located at _____.

5.0 Hearing Protectors and Estimating Attenuation

A selection of suitable hearing protectors will be made available to all employees who are expected to have 8-hour TWA noise exposures above 85 dBA. The types anticipated to be available include:

Protection Type	Attenuation

Hearing protector attenuation will be evaluated by _____ for specific noise environments according to the following method prior to determining their suitability for use:

1.
2.
3.

The following site personnel will be required to wear hearing protectors during specific activities as determined in accordance with 29 CFR 1910.95 and the results of site-specific monitoring conducted according to Section 1.0 of this program. (*This section can be completed after monitoring, if necessary*).

Employee Name	Activity Type	Type of Protection

Hearing protectors will be properly fitted by _____ upon initial distribution to site workers. Size and type of protector for each employee fitted will be recorded in the PPE form found in SH&E 116, *Personal Protective Equipment*.

Training in the use and care of hearing protectors shall be conducted by _____ during the initial site-specific health and safety training (*as part of the PPE section*) required by the AECOM SH&E Manual. Training contents shall be as per the requirements set forth in SH&E 114, *Hearing Conservation Program* and 29 CFR 1910.95.

Hearing protectors will be distributed by _____ from the storage location at the _____.

6.0 Access to Information and Training Materials

All information required by 29 CFR 1910.95 to be made available to the employees will be posted by (*insert Name/Title*) _____ at the _____.

OSHA standard 29 CFR 1910.95 will also be kept on site.

7.0 Recordkeeping

Records required by 29 CFR 1910.95 shall be completed by _____ and maintained at the _____ and placed on permanent file at the _____, for the minimum duration required by the standard. Employees can access their individual records by contacting (*insert Name/Title*) _____.

All records required by this section will be transferred to any employee's successive employer if AECOM ceases to do business.

8.0 Approvals

Project Manager: _____ Date: _____

SH&E Representative: _____ Date:_____

AECOM	SH&E No.:	114
	Rev:	Original
Respiratory Protection Program **AECOM Safety, Health and Environmental Procedure**	Date:	October 5, 2009

1.0 PURPOSE

Establishes methods that AECOM will use to prevent employee exposure to hazardous concentrations of airborne contaminants or to supply breathing quality air to employees working in oxygen-deficient atmospheres.

2.0 SCOPE

This SOP applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Air-purifying respirator – A respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Approved – Equipment tested and listed by the Bureau of Mines, or jointly by the Mining Enforcement and Safety Administration (MESA) and the National Institute for Occupational Safety and Health (NIOSH), or jointly by the Mine Safety and Health Administration (MSHA) and NIOSH.

Assigned protection factor (APF) – The ratio of the ambient concentration of an airborne substance (outside the respirator) to the concentration of the substance inside the respirator. NIOSH defines this as 10 for an approved half-face respirator and 50 for an approved full-face respirator.

Atmosphere-supplying respirator – A respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere, and includes supplied-air respirators (SARs) and self-contained breathing apparatus (SCBA) units.

Breakthrough – The first perception of an odor, taste or irritation experienced while wearing an air-purifying respirator. Breakthrough is generally an indication that the cartridges are saturated and are no longer filtering out the contaminant. Breakthrough can also be an indication of an improperly functioning respirator.

Confined space – An enclosure, such as a storage tank, process vessel, boiler, silo, tank car, pipeline, tube, duct, sewer, underground utility vault, tunnel, or pit, having limited means of egress and poor natural ventilation and which may contain hazardous contaminants or be oxygen deficient.

Canister or cartridge – A container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Demand respirator – An atmosphere-supplying respirator that admits breathing air to the facepiece only when a negative pressure is created inside the facepiece by inhalation.

Emergency situation – Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure – Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator (ESLI) – A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Escape-only respirator – A respirator intended to be used only for emergency exit.

Filter or air purifying element – A component used in respirators to remove solid or liquid aerosols from the inspired air.

Filtering facepiece (dust mask) – A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Fit factor – A quantitative estimate of the fit of a particular respirator to a specific individual, and typically estimates the ratio of the concentration of a substance in ambient air to its concentration inside the respirator when worn.

Fit test – The use of a protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual. (See also Qualitative fit test QLFT and Quantitative fit test QNFT.)

Helmet – A rigid respiratory inlet covering that also provides head protection against impact and penetration.

HASP – Health and Safety Plan

Hazardous atmosphere – Any atmosphere, either immediately or not immediately dangerous to life or health, which is oxygen-deficient or which contains a toxic or disease-producing contaminant exceeding the legally established permissible exposure limit (PEL) or, where applicable, the Threshold Limit Value (TLV) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

High efficiency particulate air (HEPA) filter – A filter that is at least 99.97% efficient in removing monodisperse particles of 0.3 micrometers in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Hood – A respiratory inlet covering that completely covers the head and neck and may also cover portions of the shoulders and torso.

Immediately dangerous to life or health (IDLH) – An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Loose-fitting facepiece – A respiratory inlet covering that is designed to form a partial seal with the face.

Maximum use concentration (MUC) – The protection factor (PF) of an approved respirator assembly times the permissible exposure limit (PEL). MUC = PF x PEL

Negative pressure respirator (tight fitting) – A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

Oxygen deficient atmosphere – An atmosphere with oxygen content below 19.5% by volume.

Powered air-purifying respirator (PAPR) – A respirator that contains a blower which passes ambient air through an air-purifying component. Air-purifying respirators may be half-face (covering the nose and mouth) or full-face (covering the eyes, nose, and mouth).

Physician or other licensed health care professional (PLHCP) – An individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide, or be delegated the responsibility to provide, some or all of the health care services required by paragraph (e) of this section.

Positive pressure respirator – A respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator (PAPR) – An air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Program administrator – The individual that has the responsibility to assure full compliance with this SOP and determines the need for medical evaluations or any other additional medical attention in regards to the use of a respirator.

Pressure demand respirator - A positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test (QLFT) – A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent.

Quantitative fit test (QNFT) – An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respiratory inlet covering – That portion of a respirator that forms the protective barrier between the user's respiratory tract and an air-purifying device or breathing air source, or both. It may be a facepiece, helmet, hood, suit, or a mouthpiece respirator with nose clamp.

Self-contained breathing apparatus (SCBA) – An atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life – The period of time that a respirator, filter or sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator (SAR) or airline respirator – An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Tight-fitting facepiece – A respiratory inlet covering that forms a complete seal with the face.

User seal check – An action conducted by the respirator user to determine if the respirator is properly sealed to the face.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROGRAM ADMINISTRATOR

The AECOM Corporate SH&E Director is the Respiratory Protection Program Administrator. The Program Administrator shall:

- Assure full compliance with this SOP
- Determine the need for medical evaluations or any other additional medical attention in regards to the use of a respirator
- Perform the program evaluations described in Section 5.9 of this SOP.

4.2 DISTRICT/OFFICE MANAGER AND PROJECT MANAGER (INCLUDING FIELD TASK MANAGER, SUPERVISOR)

- District/Office Managers and Project Managers shall ensure compliance with the respiratory protection program set forth in this procedure.
- The District/Office Managers and Project Managers shall ensure that only those employees who are medically qualified, properly trained and fit tested are assigned to respirator work.
- The District/Office Managers and Project Managers shall assure that respirators are provided, repaired, or replaced as may be required due to wear and deterioration.

4.3 REGIONAL SH&E

- Regional SH&E Manager – Shall monitor compliance with the various aspects of this program, provide technical assistance regarding respirator selection and use, evaluate the effectiveness of this program, and support respirator training and fit testing. The Regional SH&E Manager will also audit company compliance with this procedure.

4.4 EMPLOYEES

- Will use the provided respiratory protection in accordance with instructions and training received.
- Will guard against damage to the respirator.
- Will report immediately any malfunction of the respirator to the supervisor or other responsible person.

5.0 PROCEDURE

5.1 MEDICAL SURVEILLANCE

No employee shall be assigned to a task that requires the use of a respirator unless it has been determined that he/she is physically able to perform the work while using the required respirator.

Prior to wearing a respirator, employees must complete an initial baseline medical surveillance examination performed by a PLHCP in accordance with the requirements of the Medical Surveillance Program (SH&E SOP 401 – *Medical Surveillance Program*).

Employees who continue to use respiratory protection must receive an annual medical surveillance examination.

Additional medical examinations will be provided to employees who wear respirators if/when:

- An employee reports medical signs or symptoms that are related to ability to use a respirator;
- A PLHCP, supervisor, or the respirator program administrator determines that an employee needs to be reevaluated;
- Information from the respiratory protection program, including observations made during fit testing and program evaluation, indicates a need for employee reevaluation; or
- A change occurs in workplace conditions (e.g., physical work effort, protective clothing, temperature, etc.) that may result in a substantial increase in the physiological burden placed on an employee.

All medical surveillance examinations shall be confidential, during normal working hours, convenient, understandable, and the employee will be given chance to discuss results with examining physician.

5.2 TRAINING

Employees who wear respiratory protection must receive training before they are assigned to a task that requires the use of respiratory protection.

Retraining shall be administered annually, and when the following situations occur:

- Changes in the workplace or the type of respirator render previous training obsolete;
- Inadequacies in the employee's knowledge or use of the respirator indicate that the employee has not retained the requisite understanding or skill; or
- Any other situation arises in which retraining appears necessary to ensure safe respirator use.

5.2.1 Frequency of Training

Respirator training will be included in the Initial 40-Hour and the Annual 8-Hour training classes conducted by AECOM's SH&E Department for HAZWOPER and when respirators are otherwise required. As such, all employees who may have the need to wear respiratory protection are required to participate in AECOM's internal SH&E training program. In addition, AECOM's SH&E Department will conduct additional respirator training classes, as necessary, for those who may need to wear respiratory protection but did not participate in AECOM's HAZWOPER training classes.

5.2.2 Basic Respirator Training Program

Respirator training classes will include, at a minimum, the following:

- Instruction in the nature of the respiratory hazards, whether acute, chronic, or both, and a description of potential health effects if the respirators are not used.
- Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator.

- The limitations and capabilities of the respirator.
- Proper fitting, including demonstrations and practice in wearing, adjusting, determining the fit of, and performing a user seal check (in accordance with Attachment 8.2) each time respirator is donned.
- How to inspect, put on, use and remove the respirator.
- How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions.
- The procedures for maintenance and storage of the respirator.
- How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.
- The general requirements of the OSHA Respiratory Protection Standard.

5.2.3 Training Records

Respiratory protection training records will be maintained by the SH&E Regional Safety Manger. On-site records of training and fit testing will be maintained as necessary.

5.2.4 Client Required Training

For situations where trainings are required by and provided by clients, copies of SH&E Records shall be maintained by AECOM.

5.3 RESPIRATOR FIT TESTING

All employees who are required to wear a respirator with a tight-fitting facepiece must be fit-tested for that respirator.

Employees are only approved to wear the brand and model respirator for which they have been successfully fit-tested within the past year.

5.3.1 Respirator Selection

AECOM will maintain air purifying respirators and cartridges from at least two providers (i.e. MSA and North). Prior to fit-testing, the employee shall be allowed to pick the most comfortable respirator from the brands offered.

5.3.2 Fit Testing Procedures

Respirator fit-testing must be performed by a member of the SH&E Department or a designated and qualified representative. One of the following types of respirator fit testing will be provided:

- Qualitative Fit Testing (QLFT) – Irritant Smoke, Banana Oil, Saccharin or equivalent protocol
- Quantitative Fit Testing (QNFT) – Ambient aerosol condensation nuclei counter (CNC) protocol (e.g., Portacount™)

QNFT must be used for:

- All air-supplied respirators with tight-fitting facepieces
- Air purifying respirators that must achieve a fit factor of 100 or greater.

All fit testing must be performed with the respirator facepiece operating in the negative pressure mode.

Qualitative and quantitative respirator fit-testing protocols are provided in Attachment 8.1 of this SOP.

5.3.3 Fit Testing Frequency

Fit tests will be performed:

- Prior to initial use of the respirator,

- Whenever a different respirator facepiece (size, style, model or make) is used; and,
- At least annually thereafter.

Additional fit tests will be performed:

- Whenever there is an indication that changes in the employee's physical condition might have an effect on respirator fit. (Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.)
- If the employee notifies his/her supervisor or SH&E Regional Safety Manager that the fit of his/her respirator is unacceptable.

5.3.4 Fit Testing Records

A written record of each fit test performed must be maintained in the employee's health and safety records. The form provided in Attachment 4 will be used to document each fit test.

5.4 INTERFERENCE WITH GAS-TIGHT SEAL

Respiratory protection can only be worn when it can be determined that there is no obstruction of contact between the wearer's skin and the sealing surfaces of the mask whatsoever. Such obstruction can include facial hair, head hair, and the temple bars of eye glasses.

Respirator wearers cannot be afforded protection from hazardous airborne contaminants when conditions prevent a complete gas-tight face seal.

Although eyeglass temple bars will interfere with the formation of a gas-tight face seal in the case of full-face respirators, this problem is correctable by use of internally mounted spectacle kits. Management and supervisors shall assure that employees under their supervision who regularly wear eyeglasses, and who will require the use of a full-face respirator, are provided with appropriate spectacle kits at company expense.

The use of contact lenses in hazardous atmospheres or in operations involving intense heat, molten metals or the potential for chemical splash shall be prohibited.

Since facial hair (even beard stubble) will interfere with a gas-tight seal, employees shall be required to be clean-shaven whenever the use of respiratory protection is specified.

Respiratory Protection will only be assigned to those employees without physical obstructions to a gas-tight face seal to jobs that may require the use of respiratory protection. Candidates for employment shall be made aware that their versatility may be limited if they cannot wear a respirator and that this can affect their job assignments.

5.5 SPECIFICATION OF PROPER LEVEL OF RESPIRATORY PROTECTION

The Regional SH&E Manager or his/her designated and qualified representative is responsible for specifying the proper selection and use of all respiratory protective devices including half-face and full-face air purifying respirators, airline respirators, and self-contained breathing apparatus. This information is generally specified as part of the written site-specific health and safety plan (HASP).

Employees engaged in activities not covered by a HASP must consult with the Regional SH&E Manager or his/her designated representative to determine the proper equipment prior to use. Whenever appropriate, exposure levels will be measured to assure that the actual use conditions are within the limitations of the approvals specified by NIOSH/MSHA for the selected respirator.

5.5.1 Conditions Required for Air-Purifying Respirator Use

Air-purifying respirators shall only be specified for use when it can be determined that the following conditions exist:

- The oxygen concentration is greater than 19.5%;
- The contaminant is known and its concentration can be quantified;
- The airborne contaminant concentration is below its IDLH;
- A canister or cartridge is available which is approved for the contaminant;
- The contaminant concentration is below the concentration for which the canister is approved;
- The contaminant concentration is below the Maximum Use Concentration (MUC) of the respirator.

In all cases where OSHA has specified that a particular respirator be used (asbestos, formaldehyde, benzene, arsenic, lead, etc.), that respirator, or one providing equal or better protection, shall be specified.

5.5.2 APR Filter and Chemical Cartridges

An adequate supply of the following cartridges shall be maintained in stock at each office location where respiratory protective equipment:

- High efficiency particulate air (HEPA) filter cartridges;
- Organic vapor cartridges; and
- Combination HEPA/acid gas/organic vapor cartridges

5.5.3 Change Out Schedule

Filter cartridges shall be changed out whenever an increase in breathing resistance is detected by the user.

When available, chemical cartridges that are equipped with end-of-service life indicators (ESLI) shall be utilized. In those cases, cartridges should be changed when indicated by the ESLI.

In the absence of cartridges equipped with an ESLI, employees shall change chemical cartridges on the following schedule:

- Immediately if breakthrough is perceived;
- In accordance with the change out schedule developed by the Regional SH&E Manager in the site-specific health and safety plan (HASP); and
- After each day's use.

The change out schedule will be based upon the anticipated contaminant concentration, environmental conditions, employee work rate, and the specific data provided by manufacturers such as MSA's Cartridge Life Expectancy Calculator™ and North's EZ-Guide Respirator Selection™ software.

When PAPRs are worn, the same rules apply with the exception that filter cartridges should be changed when airflow through the filter elements decreases to an unacceptable level, as indicated by the manufacturer's test device.

5.6 AIR-SUPPLYING RESPIRATOR USE

5.6.1 Conditions Requiring Use of Air-Supplying Respirators

Air-supplying respirators will be specified for use when it has been determined that any of the following conditions exist:

- The oxygen concentration is less than 19.5%;
- The contaminant is unknown or its concentration cannot be quantified;
- The airborne contaminant concentration is above its IDLH;
- An air-purifying respirator canister or cartridge is not available which removes the contaminant;
- The contaminant concentration is above the concentration for which an air-purifying canister or cartridge is approved; or
- The contaminant concentration is above the Maximum Use Concentration (MUC) of a full-face air-purifying respirator.

No employee may engage in an operation requiring the use of an air-supplied respirator unless a representative of the Safety & Health Department has reviewed the operation and approved its use.

The determination of the type of air-supplying respirator (i.e., SCBA, air-line, demand, pressure demand, etc.) which is appropriate for the job, outside standby persons, communication, proper training and equipment, notification procedures, and necessary action all require planning. Mandatory equipment including SCBA or SAR with auxiliary air supply & emergency appropriate retrieval equipment or equivalent rescue means will be made by the Regional SH&E Manager or his/her designated representative at the time of review. The need for any additional precautions (i.e., equipment specific training, on-site H&S support, etc.) will also be determined by the Regional SH&E Manager.

Minimum Procedures for IDLH atmospheres

- One employee or, when needed, more than one employee shall be located outside the IDLH atmosphere: this employee shall be responsible for communicating with the employees in the IDLH atmosphere, alerting rescue services if needed, and restricting entrance to the IDLH area by untrained and unapproved persons.
- Visual, voice, or signal line communication shall be maintained between the employee(s) in the IDLH atmosphere and the employee(s) located outside the IDLH atmosphere.
- The employee(s) located outside the IDLH atmosphere shall be trained and equipped to provide effective emergency rescue or to initiate onsite rescue services.
- If on-site rescue services are to be used, the Site Safety Officer shall confirm the service is available to respond prior to any employees entering the IDLH area.
- Employee(s) located outside the IDLH area and/or on-site rescue services shall be equipped with:
  - Pressure demand or other positive pressure SCBAs, or a pressure demand or other positive pressure supplied-air respirator with auxiliary SCBA; and either
  - Appropriate retrieval equipment for removing the employee(s) who enter(s) these hazardous atmospheres where retrieval equipment would contribute to the rescue of the employee(s) and would not increase the overall risk resulting from entry; or
  - Equivalent means for rescue where retrieval equipment would create a hazard to the workers in the IDLH area.

5.6.2 Breathing Air Quality

Compressed air used for respiration shall be of high purity and shall meet, as a minimum, the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Specification G-7.1 (ANSI Z86.1).

Oxygen shall NOT be used as a source of breathing air at any time in open-circuit SCBAs or air-line respirators.

5.6.3 Compressor Supplied Breathing Air

- All compressors used for filling SCBA air cylinders or for supplying air-line respirators shall be equipped with the following safety and standby devices:
- The compressor intake shall be located to assure that only respirable (uncontaminated) air is admitted. This requires attention to the location of the compressor intake with respect to compressor engine exhaust, chemical storage or use areas, and suitable intake screening or filtration.
- Alarms to indicate compressor failure (such as low-pressure air horns, etc.) shall be installed in the system.
- A receiver of sufficient capacity to enable the respirator wearer to exit from a contaminated atmosphere shall be provided.
- If an oil-lubricated compressor is used to supply breathing air, it shall be equipped with both of the following devices:
  - A continuous reading carbon monoxide monitoring system set to alarm should the carbon monoxide concentration exceed 10 ppm; and,
  - A high temperature alarm which will activate when the discharge air exceeds 110% of the normal operating temperature in degrees Fahrenheit.
- An in-line purifying filter assembly to remove oil, condensed water, particulates, odors, and organic vapors shall be used in conjunction with the air compressor.
- Routine inspection and maintenance of air compressor shall be performed.

5.6.4 Compressed Air Cylinders

Breathing air cylinders shall be legibly identified with the word AIR by means of stenciling, stamping, or labeling as near to the valve end as practical.

Cylinders shall be stored and handled to prevent damage to the cylinder or valve.

Cylinders shall be stored upright with the protective valve cover in place and, in such a way (e.g. supported with substantial rope or chain in the upper one third of the cylinder, or in racks designed for this purpose) as to prevent the cylinder from falling.

Cylinders shall not be dropped, dragged, rolled, or allowed to strike each other or to be struck violently. Cylinders shall never be exposed to temperatures exceeding 125^0 F. Cylinders with visible external damage, evidence of corrosion damage, or exposure to fire shall not be accepted or used.

Only cylinders within current hydrostatic test periods shall be used. Steel cylinders must be hydrostatically tested every five years and fiberglass wrapped aluminum cylinders must be tested every three years.

5.6.5 Compressed Air Cylinder Systems for Air-Line Respirators

Compressed air cylinder systems used to supply air-line respirators shall be equipped with low pressure warning bells (e.g., Scott Pak-Alarm) or similar warning devices to indicate air pressure in the manifold below 500 psi. When such systems are used, one employee shall be assigned as safety standby within audible range of the low pressure alarm.

Air-line hose couplings shall be incompatible with outlets for other gas systems to prevent inadvertently supplying air-line respirators with non-respirable gases or oxygen.

The air pressure at the hose connection to air-line respiratory equipment shall be within the range specified in the approval of the equipment by the manufacturer.

5.6.6 Compressed Air Cylinder Systems for Recharging SCBAs

When a cascade system is used to recharge SCBA air cylinders, it shall be equipped with a high-pressure supply hose and coupling rated at a capacity of at least 3000 psi.

5.6.7 Escape/Egress Units

These respirators are intended for use in areas where escape with a short-term (5 minutes) air supply is necessary.

They may be used as adjuncts to airline pressure demand respirators as a backup air supply or as independent emergency devices in areas where respiratory protection is not normally required.

Appropriate training shall be accomplished and documented prior to assigning employees to tasks or locations subject to the use of these respirators.

Escape/egress units (5 minutes) shall never be used to enter a hazardous atmosphere or as primary standby respirators for confined space entry.

5.7 RESPIRATOR INSPECTION, CLEANING, MAINTENANCE, AND STORAGE

When respirator use is required, only properly cleaned and maintained NIOSH/MSHA approved respirators shall be used.

5.7.1 Inspection

All respirators shall be inspected routinely by the user before, during, and after each use. Defects shall be reported to supervision. No defective respirator shall be issued or worn.

Routinely used respiratory equipment shall be inspected by an individual qualified by experience or training to do the work.

5.7.2 Cleaning and Maintenance

Respirator facepiece assemblies shall be cleaned and sanitized minimally after each day of use in accordance with the requirements specified in Attachment 8.3 of this SOP.

Respiratory equipment shall not be passed from one person to another until it has been cleaned and sanitized.

Respiratory equipment shall be maintained according to manufacturer's instructions.

Where respirators are assigned to individual employees, management shall ensure compliance with cleaning and maintenance requirements by periodic inspection and field audits of respiratory equipment.

5.7.3 Storage

When not in use, respirator facepieces shall be placed in clean Zip-Lock style bags and stored to protect against dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals.

5.8 HYGIENE

Employees must leave the work area to wash, change cartridges, or if they detect break-through or resistance.

5.9 PROGRAM EVALUATION

The Regional SH&E Manager will conduct evaluations of the workplace as necessary to ensure that the provisions of the current written program are being effectively implemented and that it continues to be effective.

The Regional SH&E Manager will regularly (i.e., during annual training) consult employees required to use respirators to assess their views on program effectiveness and to identify any problems. Any problems that are identified during this assessment shall be corrected. Factors to be assessed include, but are not limited to:

- Respirator fit (including the ability to use the respirator without interfering with effective workplace performance);
- Appropriate respirator selection for the hazards to which the employee is exposed;
- Proper respirator use under the workplace conditions the employee encounters; and
- Proper respirator maintenance.

5.10 RECORDKEEPING

5.10.1 Medical Records

Medical records under this section will be maintained at a minimum in accordance with 29 CFR 1910.1020 – Access to Employee Exposure and Medical Records (SH&E SOP 402 – *Access to Medical Records*).

5.10.2 Fit Test Records

Fit test records will include the name of the employee tested, the type of fit test performed, the specific style, make, model and size of the respirator tested, the date of the test and the pass/fail results for QLFTs or QNFT test documentation (i.e., strip charts).

5.11 COSTS

The costs for training, medical examinations, fit testing, respirators and cleaning materials should be considered as operational costs for the respective AECOM business lines.

6.0 REFERENCES

Title 29, Code of Federal Regulations, Section 1910.134

SH&E SOP 401 – *Medical Surveillance Program*

7.0 ATTACHMENTS

Attachment 1 – Respirator Fit Testing Protocol

Attachment 2 – User Seal Check Procedures

Attachment 3 – Respirator Cleaning Procedures

Attachment 4 – Respirator Fit Test Form

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

Fit Testing Protocol

A. Fit Testing Procedures -- General Requirements

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item A.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

(a) Position of the mask on the nose

(b) Room for eye protection

(c) Room to talk

(d) Position of mask on face and cheeks

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

(a) Chin properly placed;

(b) Adequate strap tension, not overly tightened;

(c) Fit across nose bridge;

(d) Respirator of proper size to span distance from nose to chin;

(e) Tendency of respirator to slip;

(f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

14. Test Exercises. (a) The following test exercises are to be performed for all fit testing methods prescribed in this appendix, except for the CNP method. A separate fit testing exercise regimen is contained in the CNP protocol. The test subject shall perform exercises, in the test environment, in the following manner:

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage – When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(6) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

(7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist. (8) Normal breathing. Same as exercise (1).

(b) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) AECOM will ensure that persons administering QLFT are able to calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) AECOM will ensure that that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

(a) General Requirements and Precautions

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

(5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) Sensitivity Screening Check

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) Irritant Smoke Fit Test Procedure

(1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

1. General

(a) AECOM will ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.

(b) AECOM will ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol.

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount TM) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

(1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instruction.

(2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: chin properly placed; adequate strap tension, not overly tightened; fit across nose bridge; respirator of proper size to span distance from nose to chin; tendency of the respirator to slip; self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

(5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

(6) The test subject shall be instructed to perform the exercises in Section I. A. 14 of this appendix.

(7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) Portacount Test Instrument.

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.

(3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

User Seal Check Procedures

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturers recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer’s Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

Respirator Cleaning Procedures

These procedures are provided for employer use when cleaning respirators. They are general in nature, and the employer as an alternative may use the cleaning recommendations provided by the manufacturer of the respirators used by their employees, provided such procedures are as effective as those listed here in Appendix B- 2. Equivalent effectiveness simply means that the procedures used must accomplish the objectives set forth in Appendix B-2, i.e., must ensure that the respirator is properly cleaned and disinfected in a manner that prevents damage to the respirator and does not cause harm to the user.

I. Procedures for Cleaning Respirators

A. Remove filters, cartridges, or canisters. Disassemble facepieces by removing speaking diaphragms, demand and pressure-demand valve assemblies, hoses, or any components recommended by the manufacturer. Discard or repair any defective parts.

B. Wash components in warm (43 deg. C [110 deg. F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.

C. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain.

D. When the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:

1. Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43 deg. C (110 deg. F); or,

2. Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodide/100 cc of 45% alcohol) to one liter of water at 43 deg. C (110 deg. F); or,

3. Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

E. Rinse components thoroughly in clean, warm (43 deg. C [110 deg. F] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.

F. Components should be hand-dried with a clean lint-free cloth or air-dried.

G. Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.

H. Test the respirator to ensure that all components work properly.

Air Purifying Respirator Qualitative/Quantitative Fit Test Record

Employee Name: ____________________ Office: ____________________ Employee Number: ____________________

Date: Tester:	MSA Comfo II HM S M L	MSA Ultra Twin FM S M L	North 7700 HM S M L	North 7600 FM S M/L	________ HM S M L	________ FM S M L
Qualitative Test Agent(s): IAA Smoke	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor
Date: Tester:	MSA Comfo II HM S M L	MSA Ultra Twin FM S M L	North 7700 HM S M L	North 7600 FM S M/L	________ HM S M L	________ FM S M L
Qualitative Test Agent(s): IAA Smoke	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor
Date: Tester:	MSA Comfo II HM S M L	MSA Ultra Twin FM S M L	North 7700 HM S M L	North 7600 FM S M/L	________ HM S M L	________ FM S M L
Qualitative Test Agent(s): IAA Smoke	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail	Pass Fail
Quantitative Test Device	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor	Overall Fit Factor

Instructions

1. Complete the employee information at the top of the record (one record per employee).
2. Enter the date of the test and the name of the person conducting the fit test
3. Circle the brand and model of respirator tested (e.g., MSA Comfo II, North 7700, etc.)) or enter another brand and model in one of the last two columns
4. Circle the size of the respirator tested
5. For qualitative fit tests, circle the test agent used - IAA = Isoamyl Acetate, Smoke = Irritant Smoke (Stannic Chloride) and the outcome of the test (i.e., Pass or Fail)
6. For quantitative fit tests, enter the name of the instrument used and the overall fit factor measured by the test
7. Keep a copy in the employee's training files and enter subsequent (e.g., annual) tests until the record is filled.

AECOM Personal Protective Equipment Program **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	115
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Provide an effective Personal Protective Equipment (PPE) Program to protect AECOM employees from potential workplace safety and health hazards.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

PPE – Personal Protective Equipment

ANSI – American National Standards Institute

4.0 ROLES AND RESPONSIBILITIES

4.1 REGIONAL SH&E MANAGER

- Assist in the preparation and/or review of Health and Safety Plans (HASP) as required for projects.
- Provide guidance to Project Managers, Field Task Managers, Supervisors and field staff on the assessment of hazards and the selection of PPE.
- Provide training materials to Project Managers, Field Task Managers and Supervisors for employee training.

4.2 PROJECT MANAGERS (FIELD TASK MANAGERS, SUPERVISORS)

- Conduct Hazard Assessments to identify the hazards present and specify PPE appropriate for those hazards.
- Determine which of their staff members will require employee-issued personal protective equipment.
- Approve the purchase of company-issued personal protective equipment.
- Assure that appropriate personal protective equipment is utilized by their employees when required or necessary.

4.3 EMPLOYEE

- Utilize appropriate PPE which has been issued to them when required or necessary.
- Inspect their PPE prior to use to ensure that it is functional and maintain their PPE in a clean and functional condition.
- Follow instructions and manufacturers guidance as to care, use and storage of their PPE.

5.0 PROCEDURE

The proper use of appropriate PPE, in combination with effective engineering and administrative controls, can provide AECOM employees with adequate protection against potential workplace hazards and reduce the potential for workplace injury and illness. OSHA's PPE standard (29 CFR 1910.132) requires AECOM to:

- Assess workplace(s) to determine if hazards are present which necessitate the use of PPE; and, if such hazards are present:
    - Select the appropriate types of PPE; and,
    - Provide employees with training about the use and care of the selected PPE.

5.1 HAZARD ASSESSMENT FOR OFFICE LOCATIONS

The checklist in Attachment 1 will be used to document the hazards associated with each job position. Some job positions involve several tasks that require the use of different types or combinations of PPE. If this is the case, each task will be assessed. The PPE recommendations for each task will be listed on the hazard assessment checklist.

The hazard assessment checklist will serve as the certificate of hazard assessment, as defined in 29 CFR 1910.132 (d) (2), for office activities that require PPE. This checklist will also be used to determine the PPE requirements for non-routine maintenance tasks that may not be evaluated during the initial hazard assessments.

5.2 HAZARD ASSESSMENT FOR OFF-SITE LOCATIONS

5.2.1 HAZWOPER Locations

Each health and safety plan (HASP) that is prepared for waste site investigations/remediation includes a hazard assessment for each proposed field activity. As required by 29 CFR 1910.120, task-specific PPE requirements are listed in the HASP. Therefore, the HASP will serve as the certificate of hazard assessment for each project that involves off-site work activities that require the use of PPE.

5.2.2 All Other Off-Site Locations

The HASP will serve as the certificate of hazard assessment for projects that involves offsite work activities that require the use of PPE. . The checklist will be reviewed with the entire field team prior to arriving at the site.

5.3 DETERMINING THE NEED FOR PPE

Using the hazard assessment checklist or HASP, the need for the following types of PPE will be evaluated:

5.3.1 Eye and Face Protection

The OSHA standard requires that AECOM employees use appropriate eye and face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acid and caustic liquids, chemical gases or vapors and injurious light radiation. The standard further requires that eye protection provide side protection when there is a hazard from flying objects.

5.3.2 Head Protection

Protective helmets (hard hats) are required when employees are working in areas where there is a potential for injury to the head from falling objects. When working near exposed electrical conductors that could contact the head, helmets designed to reduce electrical shock will be worn.

5.3.3 Foot Protection

Protective footwear is required when employees are working in areas where there is a danger of foot injuries due to falling and rolling objects, or objects piercing the sole and where employee's feet are exposed to electrical hazards.

5.3.4 Hand Protection

Appropriate hand protection is required when employee's hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts and lacerations; severe abrasions; punctures; chemical burns; thermal burns: and, harmful temperature extremes.

5.3.5 Chemically-Resistant Clothing

Chemically-resistant clothing is required when there is a significant potential for the employee to come in direct contact with the chemicals he/she is handling. Tasks that involve chemical handling will be evaluated for the potential of splashing or spilling.

5.3.6 High-Visibility Apparel

High visibility apparel with reflective banding (ANSI Class II and III garment) is required for all field activities in close proximity to moving traffic and other modes of transportation (transit, airlines, marine, etc.), in proximity to heavy equipment operations, or whenever otherwise specified in a project HASP. Color of apparel (orange or lime) may be client/project-specific.

5.4 PPE SELECTION

After the hazard assessments have been completed, AECOM will select the appropriate PPE for each job category or task, as necessary. The selected equipment will be indicated on the hazard assessment checklist or in the HASP. Personal Protective Equipment will be provided to each employee appropriate for the hazards present. All PPE selected and purchased by AECOM,will meet or exceed the American National Standards Institute (ANSI) standards as indicated below.

5.4.1 Eye Protection – ANSI Z87.1

AECOM will offer safety glasses with permanently attached sideshields or directly-vented goggles to all employees working in an area or at a process that involves flying particles. Non-vented and indirectly-vented goggles will be worn when employees are handling chemicals. Faceshields, in combination with glasses or goggles, will be required where a severe splash or impact hazard has been identified. When welding, employees must use equipment with filter lenses that have a shade number appropriate for protection against injurious light radiation.

5.4.2 Foot Protection – ANSI Z41

Work shoes or boots shall have leather or rubber uppers, an oil-resistant sole, and a distinctive heel (defined as a raised section 3/8" – ½" across the entire heel). When required by the regulations or the client, AECOM will provide affected employees with safety-toed shoes/boots, which meet the requirements of ANSI Z41.1.

5.4.3 Head Protection – ANSI Z89.1

On all construction projects and in the event that an overhead hazard exists, a four-point suspension Type II, Class A or B hard hat will be provided to affected employees.

5.4.4 High-Visibility Safety Apparel – ANSI/ISEA 107-104

"High visibility safety apparel" means personal protective safety clothing that is intended to provide conspicuity during both daytime and nighttime usage, and that meets the Performance Class II of III requirements of the ANSI/ISEA 107-104 publication entitled, "American National Standard for High Visibility Safety Apparel and Headwear".

5.4.5 Hand Protection - Performance Characteristics as Listed by the Manufacturer

Leather or Kevlar gloves should be used as appropriate to prevent cuts, lacerations, abrasions and punctures. Chemically-resistant gloves such as neoprene or nitrile rubber will be issued to employees who are likely to come in direct contact with chemicals. When selecting chemically-resistant gloves, AECOM will review the manufacturer's data tables regarding degradation of the glove material when exposed to the chemicals of concern, penetration of the chemicals of concern through imperfections in the gloves and permeation (breakthrough times) of the chemicals of concern through the glove material.

5.4.6 Chemically-Resistant Protective Clothing – Performance Characteristics as Listed by the Manufacturer

Whenever there is a potential for chemical splashing, disposable, chemically-resistant clothing, such as a coated-Tyvek coverall or apron, will be worn. Examples of when such clothing may be required include; 1) the cleaning of small spills, 2) non-routine tasks involving the use of chemicals; and, 3) the transfer of large quantities of chemicals from large containers to smaller ones. The process for selecting chemically-resistant clothing will be similar to that described for the selection of chemically-resistant gloves.

5.5 PPE SUPPLIES

Each AECOM office will maintain a supply of safety equipment including safety glasses, gloves, and chemically-resistant clothing based on the nature of their field activities. The Office Manager or designee will be responsible for maintaining this inventory. PPE that is required for large field efforts will be ordered by the Project Manager or their designee.

5.6 EMPLOYEE TRAINING

All employees assigned to use PPE will be provided training appropriate to the PPE required. The following information, at a minimum, must be covered during PPE training:

- What PPE is required.
- When it is required.
- Why it is required.
- How to properly don, doff, adjust and wear the PPE described.
- The limitations of the PPE, including its expected useful life.
- How to properly care, maintain and dispose of the PPE.

AECOM employees who have participated in the 40-hour HAZWOPER training course are considered to have met the employee training requirements of the PPE standard.

The training certificates that are issued as documentation of successful completion of the 40-hour HAZWOPER course will also serve as documentation of training as required by the PPE standard.

Employees who have not participated in the HAZWOPER training will be provided PPE training specific to their assignment and/or location. The PPE Facts Sheets (attached) can serve as the basis for training.

5.7 OBTAINING PERSONALIZED SAFETY GEAR

The Occupational Safety and Health Administration (OSHA) standard in 29 CFR 1910 - Subpart I / 29 CFR 1926 requires that protective equipment including PPE for eyes, face, head, and extremities, protective clothing, and respiratory devices be provided to employees wherever it is necessary by reason of hazards.

Employees are not expected to provide their own general PPE. Although each AECOM office stocks and issues various general issue safety gear such as hard hats, plan safety glasses, disposable gloves and coveralls, fall protection, and hearing protection, certain personalized safety gear such as prescription safety glasses, safety-toed (capped) boots and cotton coveralls must be ordered and sized specifically for the user.

Most PPE will be provided to the employee at no charge, with the exception of the above personalized safety equipment (Rx safety glasses, safety toed boots, washable coveralls). There may be a partial cost reimbursement to the employee based on legacy company practice or project stipulations.

5.7.1 Prescription Safety Glasses

Eligibility

Safety glasses must be worn by employees during activities which involve exposure to eye hazards such as flying particles, chemical splash or certain types of radiation such as ultraviolet light from welding operations. Typically, the following types of field activities will require the use of safety glasses:

- Site investigation or remediation and construction activities;
- Stack monitoring and other types of air emissions monitoring;
- Audits and assessments in industrial or manufacturing facilities;
- Activities conducted within laboratories; and,
- Activities at client facilities where safety glasses are required.

Eligibility to obtain prescription safety glasses will be determined by the employee's supervisor based upon the guidance above.

Procurement of Prescription Safety Glasses

Employees who have been authorized to purchase prescription safety glasses by their supervisor should consult the AECOM SH&E Department's Intranet Site for obtaining detailed instructions on how and where to purchase the equipment. Employees will be able to choose from several styles of approved frames, all equipped with permanently attached sideshields. Various lens materials are also available, although polycarbonate is recommended.

Except for eye examinations, associated prescription eyewear costs will be paid by AECOM. The employee may be asked to pay a dispensing fee to the optician, which may be submitted on an expense report for reimbursement. Since eye examinations are not covered, employees who have had recent eye examinations should contact the eye care professional in advance to determine their procedure for handling a current prescription.

Employees who are eligible will be allowed to order one pair of prescription safety glasses every other year from the selection of glasses offered by the program.

Contact the Regional SH&E Manager for guidance as to the procurement of prescription safety glasses.

5.7.2 Safety Toed Boots/Shoes

Eligibility

Safety boots/shoes must be worn by employees during activities which pose the potential for foot injury from dropped objects or penetrations through the sole. Typically, safety toed boots/shoes will be required for the same type of activities, with the exception of laboratory activities, for which safety glasses are required. In addition, work around all types of heavy equipment will typically require the use of safety shoes.

Eligibility to obtain safety shoes will be determined by the employee's supervisor based upon the guidance above.

Procurement of Safety Shoes

Employees who have been authorized to purchase safety shoes by their supervisor should consult the Regional SH&E Manager for obtaining for detailed instructions on how and where to purchase the equipment. The style chosen (i.e., boot or shoe) should be determined based upon the application. For example, low cut shoes may be appropriate for audits and assessments in light industry applications while safety boots will be more appropriate for environmental remediation, construction and heavy industry work with significant foot hazards. Before purchasing, the employee is required to verify that the safety boots or shoes meet the specifications above.

After the purchase, an employee expense report, including a dated receipt for the shoes, should be presented to the employee's supervisor for approval and submission. The employee will be reimbursed by AECOM up to a deductible that is specified by the SH&E Department or Regional Operations management.

Employees who are eligible will be allowed to purchase one pair of safety shoes every other year. Employees should contact their Regional SH&E Manager for guidance about procurement of safety footwear.

5.7.3 Reusable Coveralls

Eligibility

Reusable cotton (or some other washable fabric) coveralls may be made available to employees who regularly perform field work based on conditions. Coveralls can be worn over personal clothing to help protect and keep them clean.

Eligibility to obtain washable coveralls will be determined by the employee's supervisor based upon the guidance above.

Procurement of Reusable Coveralls

AECOM has established a master services agreement with a work clothing vendor which supplies us with long-sleeved, blue coveralls bearing the AECOM logo. These coveralls can be ordered through a standard purchase requisition authorized by the employee's supervisor. The cost of the coveralls will be covered entirely by your region.

Employees who are eligible will be allowed one pair of coveralls per year.

6.0 REFERENCE MATERIAL

Title 29, Code of Federal Regulations, Part 1910, Subpart 1

Title 29, Code of Federal Regulations, Part 1910.120

Title 29, Code of Federal Regulations, Part 1926

SH&E SOP 113 – *Hearing Conservation Program*

SH&E SOP 114 - *Respiratory Protection Program*

SH&E SOP 605 - *Fall Protection*

7.0 ATTACHMENTS

Attachment 1 - Personal Protective Equipment Hazard Analysis

Attachment 2 - PPE Fact Sheet – Eye Protection

Attachment 3 - PPE Fact Sheet – Head Protection

Attachment 4 - PPE Fact Sheet – Foot Protection

Attachment 5 - PPE Fact Sheet – Hand Protection

Attachment 6 - PPE Fact Sheet – Chemical Protective Clothing

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

PERSONAL PROTECTIVE EQUIPMENT HAZARD ANALYSIS

1. **Job Title(s):** This hazard analysis describes the tasks and required personal protective equipment for the following job titles:
   -
   -
   -
   -
   -

2. **Description of Tasks:** The tasks performed by personal in the above job titles include:
   -
   -
   -
   -
   -

3. **Potential Hazards and PPE Selection. (See List of Potential Hazards for assistance)**

TASK	POTENTIAL HAZARDS (1)	PPE SELECTION

(1) Refer to attached list for a list of potential hazards to consider.

Signature of certifying Manager that tasks are accurately described.

_____ _____

Signature Date

Print Name: _____

LISTS OF POTENTIAL HAZARDS

	POTENTIAL HAZARDS
HEAD	**Falling overhead objects**
	Spark contact
	Chemical contamination
	Cold/heat
	Electrical (>600 volts)
HANDS	**Cut, puncture, abrasions**
	Burns
	Dermatitis
	Chemical absorption
	Cold
FEET	**Falling or rolling objects**
	Chemical absorption
	Dermatitis
	Burns
	Cold
	Slips, trips
FACE	**Burns (chemical, spark, UV radiation)**
	Chemical splashing
	Flying particulates
	Abrasions, cuts
EYES	**Burns (gas, liquid, spark)**
	Abrasions-flying particulates
	Absorption
	Retinal/corneal damage (UV/IR radiation)
EARS	**Noise**
	Cold

BODY PROTECTION	**Chemical splashing**
	Burns (chemical, UV radiation)
	Absorption
	Spark contact
	Cuts/abrasions/punctures
	Heat/cold stress
	Moving vehicles/heavy equipment
MISCELLANEOUS	**Insects (ticks, spiders, mosquitoes, bees/wasps)**
	Animals (dogs, bears, wild boars, raccoons)
	Reptiles (snakes)
	Poison plants (poison ivy, poison sumac, poison oak)
	Biological (fungus, bacteria, fungus, viral)

TABLE 1 – EYE & FACE PROTECTION SELECTION CHART

		ASSESSMENT	PROTECTOR TYPE (see Table 2)	PROTECTOR	LIMITATIONS	NOT RECOMMENDED
IMPACT	Chipping, grinding, machining, masonry work, riveting, and sanding.	Flying fragments, objects, large chips, particles, sand, dirt, etc.	B, C, D, E, F, G, H, I, J, K, L, N	Spectacles, goggles, faceshields SEE NOTES (1) (3) (5) (6) (10) For severe exposure Add N	Protective devices do not provide unlimited protection. SEE NOTE (7)	Protectors that do not provide protection from side exposure. SEE NOTE (10) Filter or tinted lenses that restrict light transmittance, unless it is determined that a glare hazard exists. Refer to OPTICAL RADIATION.
HEAT	Furnace operation, pouring, casting, hot dipping, gas cutting, and welding.	Hot sparks	B, C, D, E, F, G, H, I, J, K, L, *N *N N	Faceshields, goggles, spectacles. *For severe exposure, add N SEE NOTE (2) (3) *Faceshields worn over goggles H, K SEE NOTE (2) (3) Screen faceshields. Reflective faceshields. SEE NOTE (2) (3)	Spectacles, cup and cover type goggles do not provide unlimited facial protection. SEE NOTE (2) SEE NOTE (3)	Protectors that do not provide protection from side exposure.
		Splash from molten metals				
		High temperature exposure				
CHEMICAL	Acid and chemicals handling, degreasing, plating	Splash	G, H, K *N	Goggle, eyecup and cover types. *For severe exposure, add N	Ventilation should be adequate but well protected from splash entry	Spectacles, welding helmets, handshields
		Irritating mists	G	Special purpose goggles	SEE NOTE (3)	
DUST	Woodworking, buffing, general dusty conditions.	Nuisance dust	G, H, K	Goggles, eyecup and cover types	Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	

TABLE 1 – EYE & FACE PROTECTION SELECTION CHART (cont.)

	ASSESSMENT	PROTECTOR TYPE	PROTECTOR	LIMITATIONS	NOT RECOMMENDED
OPTICAL RADIATION	WELDING: Electric Arc	O, P, Q	**TECTORS FILTER LENS PRO- SHADE TECTORS** SEE NOTE (9) 10-14 Welding Helmets or Welding Shields	Protection from optical radiation is directly related to filter lens density. SEE NOTE (4). Select the darkest shade that allows adequate task performance.	Protectors that do not provide protection from optical radiation. SEE NOTE (4)
	WELDING: Gas CUTTING TORCH BRAZING	J, K, L, M, N, O, P, Q	SEE NOTE (9) 4-8 Welding Goggles or Welding Faceshield 3-6 3-4	SEE NOTE (3)	
	TORCH SOLDERING	B, C, D, E, F, N	1.5-3 Spectacles or Welding Faceshield		
	GLARE	A, B	Spectacle SEE NOTE (9) (10)	Shaded or Special Purpose lenses, as suitable. SEE NOTE (8)	

NOTES

(1) Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of each of the hazards must be provided.
(2) Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
(3) Faceshields shall only be worn over primary eye protection.
(4) Filter lenses shall meet the requirements for shade designations in Table 9-2.
(5) Persons whose vision requires the use of prescription (Rx) lenses shall wear either protective devices fitted with prescription (Rx) lenses or protective devices designated to be worn over regular prescription (Rx) eyewear.
(6) Wearers of contact lenses shall also be required to wear appropriate covering eye and face protection devices in a hazardous environment. It should be recognized that dusty and/or chemical environments may represent an additional hazard to contact lens wearers.
(7) Caution should be exercised in the use of metal frame protection devices in electrical hazard areas.
(8) Refer to Section 6.5, Special Purpose Lenses. (ANSI A87.1-1989)
(9) Welding helmets or handshields shall be used only over primary eye protection.
(10) Non-sideshield spectacles are available for frontal protection only.

TABLE 2 - EYE AND FACE PROTECTOR SELECTION GUIDE

A. SPECTACLE, No sideshield
B. CUP GOGGLE, Direct ventilation
C. CUP GOGGLE, Indirect ventilation
D. SPECTACLE, Headband temple
E. COVER WELDING-BURNING GOGGLES, Indirect Ventilation
F. FACESHIELD
G. WELDING HELMET, Hand held
H. WELDING HELMET, Stationary window
I. WELDING HELMET, Lift front
J. COVER GOGGLE, Direct ventilation
K. SPECTACLE, Half sideshield
L. SPECTACLE, Full sideshield
M. SPECTACLE, Detachable sideshield
N. SPECTACLE, Non-removable lens
O. SPECTACLE, Lift front
P. COVER GOGGLE, No ventilation
Q. COVER GOGGLE, Indirect ventilation

TABLE 3. FILTER LENSES FOR PROTECTION AGAINST RADIANT ENERGY

OPERATIONS	ELECTRODE SIZE 1/32 INCH	ARC CURRENT	MINIMUM PROTECTIVE SHADE
Shielded metal-arc welding	Less than 3	Less than 60	7
	More than 3-5	60-160	8
	More than 5-8	161-250	10
	More than 8	251-550	11
Gas metal arc welding and flux cored arc welding		Less than 60	7
		60-160	10
		161-250	10
		251-500	10
Gas tungsten arc welding		Less than 50	8
		50-150	8
		151-500	10
Air carbon	(Light)	Less than 500	10
Air cutting	(Heavy)	500-1000	11
Plasma arc welding		Less than 20	6
		20-100	8
		101-400	10
		401-800	11
Torch brazing			3
Torch soldering			2
Carbon arc welding			14

8.1.1.1 OPERATIONS	PLATE THICKNESS (INCHES)	(MM)	8.1.1.2 MINIMUM* PROTECTIVE SHADE
Gas welding:			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to ½	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen cutting:			
Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 151	5

CERTIFICATE OF EMPLOYEE TRAINING

I, the undersigned employee, have received copies of the PPE Fact Sheets as indicated above. I understand the content of those sheets and the requirements for the use of PPE as specified in this assessment. I have also discussed this information with the Health and Safety Manager.				
☐ Eye & Face Protection	☐ Head Protection	☐ Foot Protection	☐ Hand Protection	☐ Chemical Protective Clothing

Employee Signature	Health and Safety Manager Signature

PPE Fact Sheet - Eye and Face Protection

Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. Personal protective equipment is designed to protect many parts of your body including eyes, face, head, hands and feet. AECOM has evaluated each of the job tasks performed in AECOM offices. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of eye and/or face protection. This fact sheet has been developed to inform you about why eye and face protection is needed, when it should be worn, how to wear and adjust it properly, the limits of this type of PPE and how to properly maintain and clean the eye and face protection you are issued.

TYPES OF EYE AND FACE PROTECTION

There are three major types of eye and face protection, including:

Primary Protectors

Safety glasses

The most widely used form of eye protection is safety glasses. To prevent lateral exposure to impact fragments, safety glasses are often equipped with side shields. Depending on the hazard, side shields can be either a cup-type or flat-folded. The cup-type provides more complete protection.

Safety goggles

- Vented goggles - impact only
- Indirectly vented - chemical splash and impact
- Non-vented - chemical fumes

Glasses offer excellent protection against impact; however, goggles form a tight-fitting seal to the skin around the entire eye and are more appropriate for chemical concerns.

Secondary Protectors

Faceshield

Wear faceshields when there is a severe danger from impact or chemical splash. Faceshields are secondary protectors and must be worn over safety glasses or goggles.

Welding Helmet or Faceshield

When welding, employees must use equipment with filter lenses that have a shade number appropriate for protection against injurious light radiation.

CLEANING AND MAINTAINING SAFETY EYEWEAR

- Clean lenses and frames regularly with soap and water. Store in a clean, dry area.
- Replace scratched, pitted, cracked or broken safety eyewear immediately.

PROPER FIT/ADJUSTING GLASSES

PPE that fits poorly will not afford the necessary protection. When fitting devices for eye protection against dust and chemical splashes, be sure that the devices are sealed to the face. If the temple bars of the glasses are too long, the glasses will have a tendency to fall forward and slide down your nose. Check with your health and safety coordinator if you need glasses with adjustable temple bars. Standard safety glasses are 58 mm in size; however, smaller sizes (54 mm) are also available.

WHEN TO WEAR PROTECTION

Hazard	Concern	Glasses	Goggles	Faceshield
Impact	Flying fragments from front/sides	Safety glasses with sideshields	Vented goggles	Severe danger from impact. Wear with glasses/goggles
Chemicals	Splash		Indirectly vented	Severe splash. Wear with goggles.
Chemicals	Fumes		Non-vented	
Injurious Light			Welding goggles with appropriate shaded lens	Welding helmet with appropriate shaded lens
Dust	Dust entering the eye	Safety glasses with sideshields	Vented goggles	

PRESCRIPTION GLASSES/CONTACT LENSES

AECOM has selected several types of safety glasses and goggles which meet the standards specified in the OSHA PPE Standard. Prescription eyeglasses must not be substituted for safety eyeglasses. Regular eyeglasses do not offer the same impact resistance of the lens and frame assembly as safety glasses and are not ANSI-approved. Goggles can be worn over eyeglasses. If you wear corrective lenses, contact your health and safety coordinator for information about how to obtain prescription safety glasses.

Contact lenses are not recommended for any industrial job. Dust caught underneath the lens can cause painful abrasions. Some chemicals can react with your contacts to cause permanent injury.

PPE Fact Sheet - Head Protection

Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. Personal protective equipment is designed to protect many parts of your body including eyes, face, head, hands and feet. AECOM has evaluated each of the job tasks that are performed in the office. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards.

Since there is no potential for injury to the head from falling objects, head protection is not required. However, there may be some non-routine maintenance tasks or construction activities that may require such equipment. The need for this type of PPE while performing such non-routine tasks will be evaluated by your health and safety coordinator.

TYPES OF HEAD PROTECTION

The main type of head protector is the helmet. Helmets are designed to protect you from impact and penetration caused by objects hitting your head, and from limited electrical shock or burns. The shell of the helmet is designed to absorb some of the impact. The suspension, which consists of a headband and strapping, not only holds the helmet in place, but is critical for absorbing and distributing impact shock loads.

Type I helmets offer the greatest protection from falling objects. They have a continuous brim surrounding the entire shell. The Type II cap is commonly referred to as a hard hat. The Type II helmet provides the same protection for the crown of the head but lacks the brim to protect the shoulders and the neck.

Class A helmets are made from insulating material to protect you from falling objects and electric shock by voltages up to 2,200 volts. **Class B** helmets are made from insulating material to protect you from falling objects and electric shock by voltages of up to 20,000 volts. **Class C** helmets are designed to protect you from falling objects but are not designed for use around live wires or where corrosive substances are present. AECOM typically issues a Class C, Type 1 hardhat.

PROPER FIT/MAINTENANCE

The suspension of the hard hat must be adjusted to fit the wearer and to keep the shell a minimum distance of one- and one-fourth inches above the wearer's head. Periodically inspect the suspension of your hard hat. Look for loose or torn cradle straps, loose rivets, broken sewing lines or other defects. Replace the hat after a major impact.

PPE Fact Sheet - Foot Protection

Nearly two million people are expected to receive disabling work-related injuries this year. More than one-fourth of these injuries will involve the head, eyes, hands or feet. Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. Personal protective equipment is designed to protect many parts of your body including eyes, face, head, hands and feet.

AECOM has evaluated each of the job tasks that are performed in the offices. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type or types of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of foot protection.

Foot injuries are most likely to occur:

- When heavy or sharp objects fall on your foot;
- When something rolls over your foot; or
- When you step on an object that pierces the sole of your shoe.

TYPES OF FOOT PROTECTION

Safety shoes and boots must meet the requirements of ANSI Z41.1. Safety shoes and boots are made with a steel-reinforced box toe to protect your foot from being pierced or crushed by a falling object. Safety shoes or boots with flexible steel insoles provide puncture resistance. They will stop or deflect nails or other objects that have penetrated the sole of the shoe. Oil resistant soles provide the added safety feature of preventing slips and trips on slippery work floors.

LIMITATIONS OF FOOT PROTECTION

Wearing safety shoes will adequately protect your feet from most impact hazards. However if the load on the toebox becomes too great (75 foot-pounds or greater), the toe box will be crushed.

PROPER FIT

Like most PPE, the more comfortable it is to use, the more likely you will be to use it. The fit of the safety shoe is of the utmost importance. Safety shoes must be tried on by the employee before purchasing them. When selecting shoes, be sure that they are ANSI-approved. Consult with your health and safety coordinator about how to obtain safety shoes.

PPE Fact Sheet - Hand Protection

Personal protective equipment (PPE) is designed to protect you from health and safety hazards that cannot be removed from your work environment. PPE is designed to protect many parts of your body including eyes, face, head, hands and feet. AECOM has evaluated each of the job tasks that are performed in the office. The purpose of these evaluations was to assess the hazards associated with a specific task and to determine what type(s) of PPE will adequately protect you from those hazards. It has been determined that your job will require the use of hand protection. This fact sheet will inform you about why and when hand protection is needed, the limits of the gloves and how to properly clean and dispose of the gloves.

TYPES OF HAND PROTECTION

Hand protection is required when there is a potential for:

- Skin absorption of harmful substances;
- Severe cuts or lacerations, abrasions or punctures;
- Vibration; and,
- Temperature extremes.

Gloves are the most common protectors for the hands. Unfortunately, there is not one type of glove that provides adequate protection against all potential hand hazards. Leather gloves provide good protection from cuts and lacerations but offer no protection against chemicals. Nitrile or neoprene rubber gloves offers good resistance to chemicals but they tear and rip easily when sharp objects are handled. The chemically-resistant gloves used by AECOM were selected based on the manufacturer's chemical compatibility data which indicates how each glove material performed in breakthrough time tests against certain chemicals. Do not substitute another type of glove for the chemically-resistant gloves that have been selected. They may not offer adequate protection for the chemicals you handle.

PROPER FIT/CLEANING/DISPOSAL

Gloves will deteriorate over time depending on the types and amount of chemicals they come in contact with. Remove excessive chemical residue that builds up on the glove. Replace cracked, ripped or torn gloves or when breakthrough occurs. Breakthrough is the time between initial contact of the chemical on the glove surface and the detection of the chemical on the inside of the glove. Tight-fitting gloves can cause fatigue while loose fitting gloves can be hazardous. Measure the circumference of your hand around the palm area. This measurement, in inches, is closest to your actual glove size. For example, 7" is equal to a size 7 glove. Always select the right size glove from the safety supply cabinet. Dispose of chemically-resistant gloves in accordance with the established protocols at your office.

PPE Fact Sheet – Chemical Protective Clothing

Whenever there is a potential for chemical splashing, disposable, chemically-resistant clothing, such as a coated-Tyvek coverall or apron, will be worn. Examples of when such clothing may be required include:

- Cleaning of small spills;
- Washing and rinsing of the printing presses;
- Non-routine tasks involving the use of chemicals; and,
- The transfer of large quantities of chemicals from large containers to smaller ones.

The process for selecting chemically-resistant clothing will be similar to that described for the selection of chemically-resistant gloves. The need for chemically-resistant clothing will be determined by your health and safety coordinator. The required clothing will be issued to you by the SH&E coordinator. If there is an item that is routinely used by a specific group of employees within one department, the department manager can assume the purchasing responsibilities.

TYPES OF CHEMICALLY-RESISTANT CLOTHING

Like gloves, the objective of whole body protection is to separate the person from a contaminating or hazardous material. Disposable garments, such as Tyvek coveralls or aprons, provide this type of barrier. Uncoated Tyvek coveralls are made of a porous fabric and are designed to prevent contact with particulates. Coated Tyvek coveralls provide a nonporous barrier to protect the worker from chemical splash and vapors. Protective aprons, like chemically-resistant gloves, are made from nitrile or neoprene rubber.

PROPER FIT/CLEANING/DISPOSAL

Before donning a protective coverall, inspect it for rips or tears. Promptly remove any protective clothing that becomes ripped or torn during a particular task. Be sure the garment fits properly. The garment-to-glove seam will be taped when there is a potential for liquids to directly contact the skin because the arm of the suit shifted upward.

Single use garments, such as Tyvek coveralls will be disposed of in accordance with the environmental protocols at your office. Some clothing, such as rubber aprons, is meant for repeated use. Wipe down the apron, using soap and water, to remove any remaining liquids or residues.

AECOM Working Alone **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	306
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Establishes the requirements for communication and accountability between personnel at a work site to reduce the potential for incidents occurring to one employee without help readily available, and to facilitate the rapid mustering of assistance to employees in the event of an emergency.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Buddy System – A system of organizing employees at a work site in such a manner that each employee is accompanied by at least one other employee, or escorted by a client or contractor representative, during work site activities.

Controlled Work Areas – One or more designated work areas on a field project site where hazardous activities and/or strictly-defined operations take place. Such controlled work areas include, but are not limited to, a remediation or construction site; a restricted radius where a critical lift operation will take place could be declared a controlled work area. On a HAZWOPER site, the controlled work area is divided into the exclusion zone, the contaminated reduction zone, and the support zone.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROJECT MANAGERS (FIELD TASK MANAGERS, SUPERVISORS)

Project Managers (PM) and Supervisors shall ensure that employees and contract employees are briefed, organized, and monitored so as to meet all requirements contained in this procedure.

5.0 PROCEDURE

5.1 BUDDY SYSTEM

The Buddy System is required to be implemented by the PM or site supervisor in the following situations:

- All field projects where hazardous or potentially hazardous physical and/or chemical exposures exist (e.g., survey work near water, ditches, or traffic pattern; uneven terrain; low visibility or heat/cold stress conditions; work around construction risks or heavy machinery; work around chemical storage areas; operating power tools/equipment, etc.)
- Work within any Controlled Work Area.
- Work within a warehouse or similar storage area when using powered machinery or material handling equipment such as a forklift, or when handling chemicals.

5.2 COMMUNICATION

5.2.1 Line-of-Sight (LOS) and Direct Voice

- Once assigned as buddies, personnel shall remain in LOS and in direct voice contact at all times.
- When unusual conditions do not permit LOS and direct voice contact, the site supervisor must be informed. If permission from the site supervisor is obtained to continue the work, voice contact must be achieved using electronic communication devices such as, but not limited to, hand-held radio or cell phone.
- When electronic communication devices are used, a protocol must be established and agreed to by each buddy to ensure that periodic effective and faultless communications are maintained.

5.2.2 Emergency Response Procedures

- Because it must be assumed that an emergency situation exists (e.g., severe injury, illness, other accident situation, etc.), the site's emergency response procedures will be implemented in the event that communication is lost between buddies. Site work will cease until the emergency is resolved and the site supervisor directs personnel to restart work.
- Client or contractor personnel may be substituted for an AECOM employee's buddy only if they are designated by the client or contractor, are properly trained in this Standard Operating Procedure, and are properly trained in the site's emergency response procedures.

5.3 ALTERNATE BUDDY SYSTEM PROCESS

If the "Buddy System" is not employed on a project involving field activities, a justification must be included in the project Task Hazard Analysis (SH&E SOP 302 – *Risk Assessment and Hazard Analysis*) and conditions should be reassessed for ongoing projects based on potential changing field conditions. Cost alone is not considered an acceptable reason for conducting field work alone.

Conditions that may support a single field person include activities such as simple site visits that do not involve substantial risk of injury to the worker. For projects where the traditional "Buddy System" as described in Section 5.2 above is not implemented, an alternative communication protocol shall be implemented and documented to confirm safe return of field employees. Such decisions must be made in coordination with the SH&E Department.

6.0 REFERENCE MATERIAL

SH&E SOP 302 – *Risk Assessment and Hazard Analysis*

7.0 ATTACHMENTS

None

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

S3NA-308-PR Manual Lifting, Field

1.0 Purpose and Scope

1.1 This procedure provides the requirements for use when performing manual materials handling activities (e.g., lifting/handling of items or materials).

1.2 This procedure applies to all field staff for AECOM North America-based operations.

2.0 Terms and Definitions

2.1 **Manual Materials Handling:** Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

2.2 **Team Handling:** Team handling occurs when more than one person is involved during the lift.

3.0 Attachments

3.1 S3NA-308-WI Manual Lifting Safe Work Practices

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 The **Project Manager** will effectively implement the procedure, providing resources as required, and providing direction on proper lifting/handling techniques.

4.1.2 The **Region SH&E Manager** will assist in identifying activities with a high potential for lifting/handling strains/injuries as well as the associated mitigation strategies and training on proper lifting/manual materials handling techniques.

4.1.3 **Employees** are responsible for reviewing and following *S3NA-308-WI Manual Lifting Safe Work Practices*.

4.2 Mechanical Controls

4.2.1 Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials.

4.2.2 Mechanical assistance will be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists.

4.2.3 Objects to be moved will be secured to prevent falling and properly balanced to prevent tipping.

4.3 Administrative Controls

4.4 When significant, sustained lifting work is required, it is desirable to rotate employees to spread the work load among several people and thereby avoid fatigue.

4.5 Rotation is not simply performing a different job but instead is performing a job that utilizes a completely different muscle group from the ones that have been overexerted.

5.0 Records

5.1 None

6.0 References

6.1 OSHA Technical Manual: http://www.osha.gov/dts/osta/otm/otm_vii/otm_vii_1.html

6.2 National Safety Council: www.nsc.org

S3NA-308-WI Manual Lifting Safe Work Practices

1.0 General

1.1 Before Performing a Lift:

1.1.1 Check to see if mechanical aids such as hoists, lift trucks/dollies, or wheelbarrows are available.

1.1.2 Do not lift if you are not sure that you can handle the load safely.

1.1.3 Confirm that, based on your own physical capabilities and medical limitations, you can lift the load without overexertion. Get help with heavy or awkward loads.

1.1.4 Confirm that the load is “free” to move.

1.1.5 Check that the planned destination of the load is free of obstacles and debris.

1.1.6 Confirm that the path to the planned destination of the load is clear. Grease, oil, water, litter, and debris can cause slips and falls.

1.1.7 Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, and sheet materials like metal or glass). See Section 2.0 for additional guidance.

1.2 General Tips for Lifting

1.2.1 Prepare for the lift by warming up the muscles.

1.2.2 Make certain that your balance is good. Feet should be shoulder width apart, with one foot beside and the other foot behind the object that is to be lifted.

1.2.3 Bend the knees; do not stoop. Keep the back straight, but not vertical. There is a difference. Tucking in the chin straightens the back.

1.2.4 Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

1.2.5 Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

1.2.6 Keep the arms and elbows close to the body while lifting.

1.2.7 Carry the load close to the body. Do not twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

1.2.8 Watch where you are going!

1.2.9 To lower the object, bend the knees. Do not stoop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Confirm that your hands and feet are clear when placing the load.

1.3 Engineering Controls:

1.3.1 Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.

1.3.2 Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body—such as adjusting the height of a pallet or shelf.

1.3.3 Work methods and stations should be designed to minimize the distance between the person and the object being handled.

1.3.4 High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.

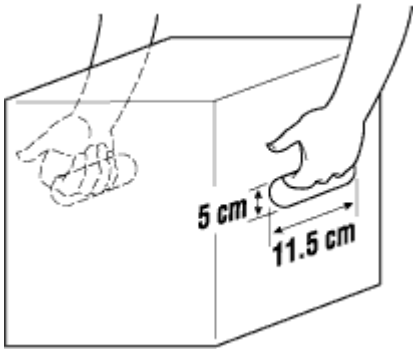
1.3.5 Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported seated posture. Bending the upper body and spine to reach into a bin or container is highly

undesirable. The bins should be elevated, tilted, or equipped with collapsible sides to improve access.

1.3.6 Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.

1.3.7 Store heavy objects at waist level.

1.4 Whenever possible, utilize hand holds or other lifting attachments on objects being handled:



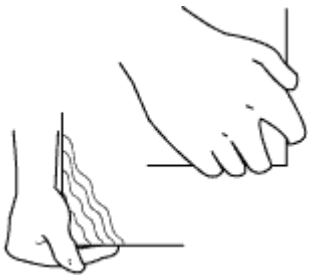
1.4.1 Use the “hook grip” on loads with cut-out handholds.

1.4.2 Curl your fingers around the edge.

1.4.3 Do not hold the load with your fingertips.

1.4.4 Use containers with handles located more than halfway up the side of the container.

1.4.5 Use the “ledge grip” to handle regularly shaped objects without handles.



1.4.6 Use vacuum lifters to handle sheet materials or plates.

1.4.7 Hold the object with hands placed diagonally.

1.4.8 Wear gloves where practical.

2.0 Specific Handling Techniques

The following guidance will be used when performing manual materials handling for various types of materials.

2.1 Square or Rectangular Objects

2.1.1 Place one foot slightly in front of the other.

2.1.2 Squat as close to the object as possible.

2.1.3 Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.

2.1.4 Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight, and tuck in the chin.

2.1.5 Test to confirm that the object is loose from floor and will lift without snagging.

2.1.6 Straighten the legs, keeping the backbone straight, pull the object into the body, and stand up slowly and evenly without jerking or twisting.

2.1.7 If turning or change of direction is required, turn with feet without twisting the torso and step in the direction of travel.

2.1.8 To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

2.2 Cylindrical Objects

2.2.1 When lifting/moving round or cylindrical objects, the objects should be rolled wherever possible. Rolling must be controlled by chute, tagline, or other means of limiting acceleration. Workers must not be positioned downhill from rolled objects. Use of the legs for pushing and tagline control of rolled objects must be stressed.

2.2.2 Cylindrical objects, such as drums that must remain upright, are to be handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks besides the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus maintaining balance and a steady, controlled, forward motion. Motion must be controlled so that ceasing to walk and moving the hands will stop forward motion.

2.2.3 Use carts or tracks to transport cylinders. Make sure that two people transport a cylinder if carts cannot be used, use lifting straps to improve grip.

- Technique for one person lifting a cylinder onto a platform:
  - Roll the cylinder to within 3 feet of the platform.
  - Position the forward foot around the cylinder, the back foot about 1 foot behind the cylinder.
  - Bend knees slightly.
  - Place one hand on the valve protective cap, the other hand underneath the cylinder about 1 foot from the ground.
  - Tilt the cylinder onto the thigh of the back leg.
  - Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
  - Extend both knees to initiate forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
  - Climb on the platform.
  - Straddle the cylinder at the valve end.
  - Grasp the valve protective cap of the cylinder with both hands between the thighs.
  - Lean forward and straighten the knees to set the cylinder upright.

2.3 Bags and Sacks

2.3.1 The best way to handle a bag depends on its size, weight, and how far it is to be carried. When lifting, remember to

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.

- Move off without bending sideways.

2.3.2 Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a coworker.

- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.
- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.
- Bend hips and knees, keeping back straight.
- Ease the bag onto the floor.

2.3.3 Bulkier sacks are easier to carry on your back. Lift the sack onto your back from a platform:

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.

2.3.4 Two-person handling of a sack:

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.
- Keep back straight.
- Grasp with the outer hand on the upper corner, the other hand holding the bottom of the sack.
- On one person's command:
  - Stand up and straighten the hips and knees.
  - Move toward the stack.
  - Put the sack on the stack.

2.4 Sheet Materials

2.4.1 When lifting sheet materials:

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the midpoint of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending or twisting body.

- Whenever moving sheet materials, be cognizant of wind conditions.

2.4.2 To carry sheets:

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.
- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.

2.4.3 Use team lifting and carrying where other solutions are inappropriate.

- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength.
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift," "walk," "stop," and "down." Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

2.5 Material Storage

2.5.1 When storing materials on site:

- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.
- Use bin racks for storing small items.
- Store heavy and frequently used materials at waist height.
- Do not store materials at floor level.
- Use hand trucks with elevating devices in storage and loading areas.
- Use trucks with a tilting device to avoid bending.
- Use elevating platforms to avoid overhead reaching.

S3NA-309-PR Mobile or Heavy Equipment

1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near mobile equipment and heavy equipment operation.

1.2 This procedure applies to all AECOM North America based employees and operations.

2.0 Terms and Definitions

2.1 **Heavy equipment:** All excavating equipment include scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, off-highway trucks, graders, agricultural and industrial tractors, and similar equipment.

2.2 **Operator:** Any person who operates the controls while the heavy equipment in is 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 Attachments

3.1 S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

3.2 S3NA-309-FM2 Heavy Machinery Pre-Operation Checklist

3.3 S3NA-309-WI Brokk180 Safety Card

4.0 Procedure

4.1 For work under AECOM's control, Project Managers are responsible for ensuring all equipment is in good working order and all equipment operators are qualified on the piece of machinery they are assigned.

4.2 Staff will confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.

4.3 The operator of mobile equipment is the only worker permitted to ride the equipment unless the equipment is a worker transportation vehicle.

4.4 A person will not operate mobile equipment unless the person has received adequate instruction and training in the safe use of the equipment, has demonstrated to a qualified supervisor or instructor competency in operating the equipment.

4.5 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment

4.6 **Communication**

4.6.1 Communication between site supervisors/managers, heavy equipment operators, and other site personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.6.2 The following outline the communication requirements during heavy equipment operations:

- Site supervisors/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 onsite 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.
- 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 (i.e., 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 guide shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.7 Ground Personnel

4.7.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.7.2 The following 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 job-specific hazard analysis that identifies any special precautions shall be completed and communicated to all AECOM personnel.
- 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 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.
- 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 heavy equipment or other objects (i.e., steel support beams, trees, buildings, etc.).
- Ground personnel shall never stand directly below heavy equipment located on higher ground.
- If working near heavy equipment, ground personnel shall stay out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
- Ground personnel shall never work near heavy equipment.
- Personnel shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Personnel shall not talk on a cell phone while standing or walking on a roadway or other mobile equipment path.

4.7.3 At a minimum, all ground personnel and operators outside of heavy equipment shall wear the following:

- High visibility, reflective (Class 2) safety vest that is visible from all angles and made of fluorescent material and orange, white, or yellow reflective material (confirm that vest is not faded or covered with outer garments, dirt, etc.).
- Retro-reflective striping for arms and legs (night work)
- ANSI-CSA approved hard hat
- ANSI-CSA approved safety glasses with side shields
- ANSI-CSA approved work boots (unless project requirements are more stringent)
- ANSI-CSA approved hearing protection as needed
- Appropriate work clothes (i.e., full length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.8 Prior to work commencing

4.8.1 All mobile equipment will be regularly inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

4.8.2 The operator will report defects and conditions affecting the safe operation of the equipment to the supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.

4.8.3 Exposed moving parts on mobile equipment which are a hazard to the operator or to other workers will be guarded and 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.

4.8.4 An approved Underwriter's Laboratories (UL) 4A40BC fire extinguisher should be present on all mobile equipment.

4.8.5 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, mobile equipment has the 'right of way'.

4.8.6 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.

4.8.7 Mobile equipment in which the operator cannot directly or by mirror or other effective device see immediately behind the machine will have an automatic audible warning device which activates whenever the equipment controls are positioned to move the equipment in reverse, and if practicable, is audible above the ambient noise level.

4.9 Operation

4.9.1 The operator of mobile equipment will operate the equipment safely, maintain full control of the equipment, and comply with the laws governing the operation of the equipment.

4.9.2 A supervisor will not knowingly operate or permit a worker to operate mobile equipment which is, or could create, an undue hazard to the health or safety of any person.

4.9.3 The operator of mobile equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement such as by setting the parking brake, placing the transmission in the manufacturer's specified park position, and by chocking wheels where necessary.

4.9.4 The operator will maintain the cab, floor and deck of mobile 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.

4.9.5 If mobile 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.

4.9.6 When approaching or crossing the intended path of travel of mobile equipment, establish eye contact with the operator of the mobile equipment and confirm that it is safe to proceed.

4.9.7 Have vehicle headlights on at all times when driving in the area.

4.9.8 Park motor vehicles off the haul roads, or away from the work areas.

4.9.9 Do not wear loose clothing where there is a danger of entanglement in rotating equipment.

4.9.10 Do not enter the swing area of machines such as cranes, mobile drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so.

4.9.11 Stay out of the blind areas around mobile equipment and never assume that the equipment operators have seen them or are aware of their presence.

4.9.12 Maintain a distance of 60 cm (2 ft.) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, the area will be barricaded or guarded to prevent access.

4.9.13 Vibration from moving traffic or mobile equipment can cause excavations or spoil piles to become unstable. Be aware of the risk and keep clear.

4.9.14 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

4.9.15 All heavy equipment shall be operated at safe speeds.

4.9.16 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.9.17 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.9.18 When feasible, operators shall travel with the “load trailing”, if the load obstructs the forward view of the operator.

4.9.19 Slow down and sound horn when approaching a blind curve or intersection. Flagmen equipped with 2-way radio communications may be required to adequately control traffic.

4.9.20 Operators shall remain in cab while heavy equipment is being loaded.

4.9.21 Equipment shall be shut down prior to and during fueling. Do not smoke or use electrical devices while fueling. Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.9.22 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. Heavy equipment parked on slopes shall have the wheels chocked.

4.9.23 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.9.24 Never exit heavy equipment while it is in motion.

4.9.25 Passengers shall only ride in heavy equipment designed for occupancy of passengers.

4.9.26 Never ride on the outside of a piece of heavy equipment (e.g., tailgates, buckets, steps, etc.).

4.9.27 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.9.28 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.

4.9.29 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.

4.9.30 Equipment left unattended at night adjacent to traveled 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 (or the regulatory requirement for the work location) to the active roadway.

4.9.31 Pneumatic-tired earthmoving haulage equipment, with a maximum speed exceeding 15 miles per hour, shall be equipped with fenders on all wheels.

4.9.32 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not exceeded.

4.9.33 Steering or spinner knobs shall not be attached to steering wheels.

4.9.34 High lift rider industrial trucks shall be equipped with overhead guards.

4.9.35 When ascending or descending grades in excess of 5%, loaded trucks shall be driven with the load upgrade.

4.9.36 All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating or moving parts of equipment shall be guarded when exposed to contact by persons or when they otherwise create a hazard.

4.9.37 All hot surfaces of equipment, including exhaust pipes or other lines, shall be guarded or insulated to prevent injury and fire.

4.9.38 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.

4.9.39 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.

4.9.40 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

4.10 Utilities

4.10.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc.

4.10.2 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 (i.e., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath of 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.

4.11 Training

4.11.1 The operator or other qualified supervisor will provide all on-site personnel with an orientation to the mobile equipment and its associated hazards and controls.

4.11.2 Only designated, qualified personnel shall operate heavy equipment.

4.11.3 Operators shall have all appropriate local, state, or federal licenses or training to operate a designated piece of heavy equipment.

4.11.4 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 needed. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.12 Inspection and Maintenance

4.12.1 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 during work hours.

4.12.2 Maintenance records will be maintained on the site or project for mobile equipment.

4.12.3 Servicing, maintenance and repair of mobile equipment will not be done when the equipment is operating, unless continued operation is essential to the process and a safe means is provided.

4.12.4 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 certified to be in safe operating condition (certification form attached) by a competent individual seven days prior to on-site operation, and is valid for one year.

4.12.5 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 site supervisor/manager immediately. Inspection records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use the Heavy Equipment Pre-Operation Inspection Checklist (attached).

4.12.6 Defective heavy equipment shall be immediately taken out of service until repaired.

4.13 Fueling and batteries

4.13.1 A well-ventilated area shall be used for refueling.

4.13.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.13.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.13.4 No one shall spill fuel on hot surfaces. Any spillage should be cleaned before starting an engine.

4.13.5 Spilled fuel shall be cleaned with cotton rags or cloths; do not use wool or metallic cloth.

4.13.6 Open flames, lighted smoking materials, or sparking equipment shall remain well away from the fueling area.

4.13.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.13.8 Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.13.9 The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.

4.13.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.13.11 Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent buildup of a static charge.

4.13.12 Batteries shall be serviced in a ventilated area while wearing appropriate PPE.

4.13.13 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first.

4.13.14 When installing a battery, the battery shall be connected ground post last.

4.13.15 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.13.16 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.

4.13.17 Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water.

4.13.18 Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention sought immediately.

4.13.19 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 battery by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least 25 feet away from battery-charging stations.

5.0 Records

5.1 Inspection records shall be maintained with the equipment.

6.0 References

6.1 S3NA-205-PR Equipment Inspections & Maintenance

S3NA-309-FM1 Certification of Machinery and Mechanized Equipment

1.0 General Guidelines

1.1 Subcontractor equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. 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 certified to be in safe operating condition (using the attached form) by a competent individual seven days prior to onsite operation. This certification is valid for one year.

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 Exhaustive preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or the subcontractor's internal policies, schedules, and equipment SOPs.

2.1.6 Only designated qualified persons shall operate 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 taken out of service and its use shall be prohibited until safe conditions have been corrected.

2.1.9 All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be 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 Location:

1. This form provides certification 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 certification of machinery and mechanized equipment, as required by AECOM, has been made prior to but within seven calendar days in advance of use on the project site. Recertification will be required for equipment that is used on the project 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 above, and is CERTIFIED 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:

S3NA-309- FM2 Heavy Equipment Pre-Operation Checklist

Project Name/Location:															
Number/Name:							**Make/Model:**								
Hour meter reading:															
Check the following as appropriate	**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**			**Operator Name/Date**		
	SAT	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**	**SAT**	**UNSAT**	**N/A**
1. Operator qualified															
2. Overhead guard (ROPS)															
3. Horn															
4. Lights															
5. Parking brake															
6. Service brakes															
7. Steering															
8. Oil level															
9. Hydraulic oil level															
10. Radiator fluid level															
11. Major fluid leaks															
12. Windows															
13. Backup alarm															
14. Tires (visual)															

15. Seat belts															
16. Fuel leaks															
17. Fire extinguisher															
18. Fuel lines secure															
19. Electrical lines															
20. Exhaust components															
Comments/Remarks:															

S3NA-309-WI Brokk180 Safety Card

1.0 Objective/Overview

The Brokk 180 is an electric-powered 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 Safe Operating Guidelines

2.1 Prior to use, complete a pre-operation inspection to determine if the unit is in safe working condition.

2.2 Position the unit to safely perform the intended task, then deploy the outriggers to stabilize the unit.

2.3 Confirm that the operator knows what the lifting capacity is; do not exceed the lifting capacity.

2.4 Complete a subsurface utility clearance prior to excavating.

2.5 Establish a minimum 15-foot clearance around the unit.

2.6 Do not allow debris to build-up around the unit. Maintain good housekeeping practices.

2.7 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.

2.8 Personnel operating the unit with the remote control device will be properly trained and certified by a competent person.

2.9 The operator will be able to maintain line of sight visual contact with the unit at all times to assess hazards and site security.

2.10 Maintenance in excess of preventive maintenance activities (e.g., lubrication, replenishing fluids, etc.) will be performed by manufacturer personnel ONLY.

2.11 All operations will comply with the manufacturer's recommended policies.

3.0 Potential Hazards

3.1 Flying debris.

3.2 Crush/impact/pinch from extendable boom, tracks, and tipping over.

3.3 Electrocution from subsurface utilities (when excavating).

3.4 Hearing loss.

4.0 Training Requirements

4.1 Review of applicable SOPs.

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 (Level D ensemble)

5.1 Reflective traffic safety vest.

5.2 Hearing protection (ear plugs and/or ear muffs).

5.3 Leather gloves.

6.0 Other Safety Tips

6.1 Never stand under a raised boom.

6.2 Maintain a clearance of 15 feet around the unit while operating.

6.3 Pay close attention to power cords for potential tripping hazard and equipment entanglement.

6.4 Maintain line of sight visual contact with unit at al times (especially when operating from a distance).

S3NA-310-PR Rigging, Hoisting, Cranes, and Lifting Devices

1.0 Purpose and Scope

1.1 Establishes the minimum requirements for rigging, hoisting, and crane operations.

1.2 This procedure applies to all AECOM North America- based employees and operations.

2.0 Terms and Definitions

2.1 **ASME**: American Society of Mechanical Engineers

2.2 **Assembly/Disassembly Director(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 nonmanagement or management personnel. Assembly/disassembly 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 **Crane**: Any power-operated equipment that can hoist, lower, and horizontally move a suspended load.

2.4 **Critical lifts**: Hoisting operations in which a critical item or load is hoisted or moved, or in which a noncritical item is hoisted or moved in an area where critical systems or equipment could be affected. Critical lifts are lifting operations that exceed 75 percent of the crane's rated capacity or any activity involving a part, component, assembly, or piece of equipment ("item") whose dropping, upset, or collision could cause or result in the following:

- Damage that would result in serious economic consequences.
- Damage that would result in an unacceptable delay to schedule or other significant deleterious programmatic impact (such as the loss of vital data).
- Undetectable damage that would jeopardize the future operations or safety of a facility.
- A significant release of hazardous material to the environment or the creation of an undesirable condition.
- Personnel injury or significant adverse health impact, either onsite or offsite.

2.5 **Controlling Entity**: An employer that is a prime contractor, general contractor, construction manager or any other legal entity that has the overall responsibility for the construction of the project, including planning, quality, and completion.

3.0 Attachments

3.1 S3NA-310-FM1 Crane Pre-Operation Inspection

3.2 S3NA-310-FM2 Critical Lift Checklist

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Project Managers (includes Supervisors)** are responsible for confirming that all aspects of this procedure are followed and adhered to on all AECOM sites and locations for critical lifts for which AECOM is the controlling entity.

4.2 General Requirements

4.2.1 AECOM personnel will not operate powered cranes and/or tuggers without approval from the **Project Manager**, **Region SH&E Manager**, and legal.

4.2.2 Some AECOM project sites may require the setup and use of tower cranes, hydraulic cranes, boom trucks, or helicopters to facilitate movement of equipment or materials on the site or project. The hazards and controls associated with these activities will be documented on the Project Safety Plan and communicated to all site personnel before work commences.

4.2.3 Prior to mobilization, **PMs** will confirm that cranes and crane operators, signal persons, and riggers are certified/qualified and that a Crane Pre-Operational Inspection Checklist (see *S3NA-310-FM1 Crane Pre-Operation Inspection* or its equivalent) is completed and reviewed prior to each use/shift.

4.3 Assembly/Disassembly

4.3.1 Prior to assembly of any cranes, all crews will confirm:

- Their tasks.
- The hazard associated with their tasks.
- Hazardous locations they need to avoid.

4.3.2 Should a crew member change a task then that crew member will be instructed that the above requirement will be met.

4.3.3 No assembly/disassembly of cranes shall be performed underneath power lines.

4.4 Addressing Specific Hazards

4.4.1 The assembly/disassembly director supervising the operation will address the following hazards associated with the operation:

- Site and ground bearing conditions will be adequate for safe operation and to support the equipment.
- Blocking material will be sufficient in size, amount, condition, and method of stacking to sustain loads and maintain stability.
- Proper location of blocking. When used to support lattice booms or components, blocking will be appropriately placed to protect the structural integrity of the equipment and prevent dangerous movement and collapse.
- Verifying assist crane loads. Loads that will be imposed on the assist crane at each phase will be verified before operations begin.
- Boom and jib pack points. The attachment points of rigging to a boom/ boom sections, or to jib/jib sections, will be suitable for preventing structural damage and for facilitating safe handling of the components.
- The center of gravity will be identified, if necessary, for the method used for maintaining stability.
- Measures designed to prevent unintended dangerous movement will be used where there is insufficient information.
- Stability upon pin removal. Boom sections, boom suspension systems, and components will be rigged or supported to maintain stability upon the removal of the pins.
- Snagging. Suspension ropes and pendants will not be able to catch on the boom or jib connection pins or cotter pins (including keepers and locking pins).
- Struck by counterweights. The potential for unintended movement from inadequately supported counterweights and from hoisting counterweights.
- Boom hoist brake failure. The brake will be tested prior to each time reliance is to be placed on the boom hoist brake to prevent boom movement.
- If found to be insufficient, a boom hoist pawl, other locking/back-up braking device, or another method of preventing dangerous boom movement (such as blocking or using an assist crane) from a boom hoist failure will be used.
- Loss of backward stability. Backward stability before swinging upward, during travel, and when attaching or removing equipment components.
- Wind speed and weather. The effect of wind speed and weather on the equipment.

4.5 Prerequisites and Physical Qualifications

4.5.1 Operators, riggers, and inspectors shall meet the minimum requirements established by this procedure as it relates to their work.

4.5.2 As part of this procedure, all site-specific training shall be in accordance with procedure *S3NA-209-PR Project Hazard Assessment and Planning* and 29 CFR Part 1926.1400 Cranes and Derricks in Construction.

- All sling and hoist systems used on AECOM sites will be operated, inspected, and maintained in compliance with regulations.
- AECOM will only employ qualified/certified licensed equipment operators, signal persons, and riggers (for cranes, helicopters, etc.).

4.6 Personal Protective Equipment

4.6.1 All AECOM personnel operating lifting or hoisting equipment and/or functioning as riggers or signal persons shall wear a reflective equipment.

- Hard hats
- Steel-toed boots
- Reflective vest

4.6.2 Class II high visibility vest in addition to their normal personal protective Power Line Safety gear.

4.6.3 All cranes shall maintain the following minimal clearance distance from power lines**.**

Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	As established by the utility owner/operator.

4.7 Training Programs

4.7.1 Power Line Safety Training

- Each operator and crew member assigned to work with the equipment will be trained on Power Line Safety.
- Spotter: Workers as dedicated spotters will be trained to enable them to effectively perform their task under section 29 CFR 1926. 1430(g) as applicable in the US.
- Fall Protection: Any AECOM employee will be trained who may be exposed to fall hazards while on or hoisted when exposed to a fall greater than 6 feet.
- Crush/Pinch points: All AECOM employees who work with the equipment shall be trained to keep clear of holes and crush/pinch points (i.e., work area controls).

4.8 Basic Operator Training

4.8.1 Topics to be included in the basic certification criteria operator training programs shall include as a minimum the requirements listed below:

- The individual knows the information necessary for safe operation of the specific type of equipment the individual will operate, including the following:

- The controls and operating/performance characteristics.
- Use of and the ability to calculate (manually or with a calculator) load/capacity information on a variety of configuration of the equipment.
- Procedure for preventing and responding to power line contact.
- Technical knowledge:
  - Wire rope.
  - Rigging devices and their use.
  - Technical limitations of protective measure against electrical hazards.
  - The effects of load share and load transfer in multi-crane lifts.
  - Basic crane terms.
  - The basics of machine power flow systems.
  - The significance of the instruments and gauge reading.
  - The effects of thermal expansion and contraction in hydraulic cylinders.
  - Background information necessary to understand preoperation and inspection requirements.
  - How to us the safety devices and operation aids required under 29 CFR 1926.1415 and 1416.
  - How to calculate net capacity for every possible configuration of the equipment using the manufacturer's load chart.
  - How to use manufacturer-approved attachments and their effect on the equipment.
  - How to obtain dimensions, weight, and center of gravity of the load.
  - The effect of dynamic loading from wind, stopping and starting, impact loading, and moving with the load.
  - The effects of side loading.
  - The principles of backward stability.
  - Site information.
  - How to identify the suitability of the supporting ground.
  - Proper use of mats, blocking/cribbing, outriggers, stabilizers, or crawlers.
  - Identification of site hazards.
  - How to review operation plans with supervisors and other workers.
  - How to determine if there is adequate room for extension of cralers or outriggers/stabilizers and counterweights.
  - How to pick up, carry, swing, and place the load smoothly and safety on rubber tires and on outriggers/stabilizer or crawlers.
  - Proper procedure and methods of reeving wire ropes.
  - How to react to change in conditions.
  - How to shut down and secure the equipment properly while leaving it unattended.
  - Know how to apply the manufacturers' specification for operating in various weather conditions and understand how environmental conditions affect the safe operation of the equipment.
  - How to properly lever the equipment.
  - How to verify the weight of the load and rigging prior to initiating the lift.
  - How to determine where the load is to be picked up and placed and how to verity the radii.
  - Know basic rigging procedures.

- How to carry out the shift inspection.
- Know that the following operations require specific procedures and skill levels:
  - Multi crane lifts.
  - Hoisting personnel.
  - Clamshell/dragline operations.
  - Pile driving and extracting.
  - Demolition operations.
  - Operations on water.
  - Multi drum operation.
- Know the proper procedure for load control and the use of handheld tag lines.
- Know the emergency response site procedures.

- Any necessary repairs or adjustments needed for the equipment will be communicated to all affected employees at the beginning of the shift.
- Other topics identified by the training or operating organizations.

4.9 Basic Training for Signal Person

4.9.1 Topics to be included in the basic certification criteria signal person training programs shall include as a minimum the requirements listed below:

- Know and understand the type of signal used.
- Know and understand the standard method of hand signaling.
- Have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and bood deflection from hoisting load.
- Demonstrate that the signal person meets the requirements of 29 CFR 1926, 1400 through an oral or written test and through a practical test.

4.10 Basic Training for Special Equipment Operators

4.10.1 Operators of special equipment will first complete training requirements for the most applicable equipment category, such as overhead, gantry, and polar cranes; hoists; or mobile cranes. The operator of special equipment will then complete any additional classroom instruction required specific to that equipment, and will complete an on-the-job (OJT) training program for the special equipment.

4.11 Rigger Training Programs

4.11.1 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.

4.11.2 Topics in both categories shall include the same basics but the depth of detail shall match the job assignment.

4.11.3 Topics shall include the requirements listed below:

- Equipment operating characteristics, capabilities, and limitations.
- Use and inspection of slings, wire rope, chain, and synthetic fiber.
- Effect of sling angles on resultant sling loads.
- Restriction on use of come-alongs.
- 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.

4.12 Crane Inspection Training

4.12.1 Inspector training shall be established to train personnel in the inspection categories listed below.

- Overhead, gantry, and polar cranes.
- Monorail, jib, and other hoists.
- Mobile cranes.
- Wire rope.
- Rigging and rigging hardware.
- Special equipment.

4.13 Inspector Training Subcategories

4.13.1 To meet the needs of the discipline, the training may divide these categories into subcategories. For example, an inspector may be trained to inspect only mechanical portions of monorail hoists.

4.14 Scope of Inspector Training

4.14.1 Inspector training shall include basic inspection techniques and the application of manufacturer-supplied information, OSHA, ASME, and acceptance/rejection criteria.

4.15 Testing and Examination

4.15.1 Testing Phases

- Testing for operator, rigger, and inspector classifications shall include, as a minimum, a written examination comprised of questions covering training topics and a practical examination to demonstrate knowledge of equipment operating characteristics and practical application. A qualified instructor shall grade the practical examination. Documentation of training shall be maintained on site.

4.15.2 Examination Scores

- Scope standards shall be set for each examination by the training organization. The minimum passing score shall depend on the subject, testing technique, and test difficulty. A candidate may be given additional opportunities to take and pass the examination if the materials have been reviewed and the employee tests satisfactorily.

4.16 Qualification, Requalification, or Disqualification

4.16.1 Training Certificate

- After the training, testing, and OJT (if required) is successfully completed, a certificate shall be issued to the operator, rigger, or inspector. The operator's certificate shall list the equipment the operator is qualified to operate.

4.16.2 Qualification Period

- Operator, signal person, rigger, and inspector qualifications may be dependent on state or local regulations.

4.16.3 Refresher Training

- AECOM will provide refresher training on relevant topics for each employee based on the employee's conduct or an evaluation of the employee's knowledge or another indication that retraining is warranted. If for any reason the employee's manager determines that the employee should be disqualified, the manager shall write a letter of disqualification. This written statement of disqualification shall state the reason for disqualification and when, or if, the employee will be eligible to requalify.

4.17 Critical Lift Procedure

4.17.1 Critical Lift Plan

- Prior to commencing any critical lift activity, the PM will confirm that a Crane Pre-Operational Inspection Checklist and a Critical Lift Checklist (see attachments) are prepared for all critical lifts.

4.17.2 Critical Lift Plan Approval

- The Crane Operator and the Rigging Site Supervisor will review and approve the Critical Lift Plan (procedure); on projects that AECOM controls, the SH&E Department will also review and approve the Critical Lift Plan.
- Revisions to the procedure will be reviewed and approved in the same manner as the original procedure.

4.17.3 Pre-Lift Meeting

- Before the Critical Lift is performed, a safety meeting with participating personnel will be held. During this meeting, the relevant portions of the applicable Task Hazard Analysis (THA) will be covered, the Critical Lift procedure will be reviewed, and questions/concerns related to personnel involved in the lift and operation of equipment will be resolved. The safety meeting will be documented on a Tailgate Safety Briefing Form as required by *S3NA-210- PR Project Safety Meetings*.

4.17.4 Critical Lift Plan Documentation

- Once completed, the SH&E Department will maintain copies of the Critical Lift Plan. Documentation of a critical lift will include the following:
  - The Critical Lift Checklist, recording job completion with approval signatures.
  - Documentation of the safety meeting including, at a minimum, the meeting date and list of attendees.
  - Any additional documentation deemed appropriate by the SH&E Department or other responsible personnel (e.g., lessons learned).

4.17.5 Preparing for Rigging & Hoisting

- 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 for the site or project, the owners of adjacent properties or systems shall be consulted. A diagram should be prepared detailing the proposed swing paths for the crane.
- All rigging equipment, fittings, and devices will be of adequate strength for the application. All components will be capable of supporting at least five times the maximum load to which they may be subjected. If the load exceeds 85 percent of the equipment capacity or involves multi-lifts, hoisting and rigging operations will be approved by a professional engineer.
- At no time is the operator of the equipment to perform lifts that exceed the load rated capacity of the equipment.
- Only loads that have been properly rigged or have been placed in containers designed for hoisting may be lifted.
- Loads should only be rigged for hoisting by qualified persons.
- Inspect all slings before each use and maintain them in good condition. All ropes, hardware, and other fittings will be inspected regularly for wear, cracks, severe corrosion, kinks, bird caging, broken strands, burn marks, chemical damage, deformation, or other signs of obvious damage.
- Use slings of proper reach. Never shorten a line by twisting or knotting or with chain slings. Never use bolts and nuts.
- Estimate the center of gravity or point of balance. The lifting device should be positioned immediately above the estimated center of gravity.
- Select shackle and sling sizes that exceed the minimum working load limits.
- The signaller will be properly identified and will understand proper signaling techniques.

- Hoisting areas will be secured with a barrier in areas where public access is a concern. Appropriate warning signage will be posted to indicate that overhead work is being performed in the area.
- Wire ropes will be lubricated to reduce friction between wires and strands.
- Tag lines will be used to control loads.
- When two or more slings are to be connected to a hook, a shackle should be used.

4.18 **During Transport of the Load**

- When being assisted by a signal person ("spotter"), the equipment operator will maintain continuous communication with the signal person. If communication with the signal person is lost, the operator will not continue until communication has been restored.
- All personnel will be clear of the load being lifted and the load will be double-checked to ensure that it is secure before it is lifted.
- No one shall be permitted to ride the lifting hook, ball, or load.
- At no time are loads to be passed over any workers or other persons.
- No one shall pass under any part of a suspended load. Always try to anticipate the movement of the load and avoid entering the swing path of the load.
- Prepare a place to land the load and lower the load gently to keep it stable before slackening the sling or chain.
- Stay clear of loads when slings are being pulled out from underneath.
- Loose loads will be blocked before unhooking.
- If you are using a sling, a significant amount of electrical charge is generated by a helicopter and rain or light blowing snow can increase this electrical charge. To avoid receiving a stunning (but not harmful) shock, the hookup person (who is trying to unhook the load) should resist reaching up to the machine or the cable as it hovers over the load. It is important to let the load or the cable ground itself first. Under some conditions the current can arc up to 20 centimeters.

5.0 Records

5.1 All training records shall be maintained in accordance with *S3NA-003-PR SH&E Training*.

5.2 All inspection records will be maintained on site with the machine.

6.0 References

6.1 29 CFR Part 1926.1400 – Cranes and Derricks in Construction

6.2 S3NA-003-PR SH&E Training

6.3 S3NA-202-PR Competent Person Designation

6.4 S3NA-309-PR Mobile or Heavy Equipment

6.5 S3NA-406-PR Electrical Lines, Overhead

6.6 S3NA-408-PR Elevated Work Platforms and Aerial Lifts

6.7 S4NA (US)-413-PR1 Process Safety Management

S3NA-310-FM1 Crane Pre-Operation Inspection

PROJECT INFORMATION	
Project Name:	
Project/Contract Number:	Date:
Site Safety Coordinator:	Crane Operator:
Crane Model No:	Crane Manufacturer:
Crane Number:	Hours:

GENERAL REQUIREMENTS			
1.	Safety Manager has reviewed and accepted work platform use	☐ Yes	☐ No
2.	Job Hazard Analysis completed and attached	☐ Yes	☐ No
3.	Critical Lift Checklist completed and attached	☐ Yes	☐ No
4.	Area barricaded or otherwise secured from unauthorized personnel entrance	☐ Yes	☐ No
CRANE REQUIREMENTS			
5.	Load lines are capable of supporting 5 times maximum intended load (10 times for rotation-resistant wire rope)	☐ Yes	☐ No
6.	Total weight of loaded platform and related rigging does not exceed 50 percent of rated capacity per boom angle and radius	☐ Yes	☐ No
7.	Crane does not have live boom; load line hoist is regulated with a device other than the hoist brake that regulates lowering speed.	☐ Yes	☐ No
8.	Crane has a positive acting anti-two-block device that deactivates hoisting action	☐ Yes	☐ No
9.	Boom angle indicator is functional and readily visible to the operator	☐ Yes	☐ No
RIGGING REQUIREMENTS			
10.	Wire rope, shackles, and other rigging hardware are capable of supporting 5 times the maximum intended load	☐ Yes	☐ No
11.	Lifting bridles are four legs of equal length connected by common ring	☐ Yes	☐ No
12.	All eyes in wire rope slings are fabricated with thimbles	☐ Yes	☐ No
13.	Shackle bolts are secured against displacement (pinned or moused)	☐ Yes	☐ No
14.	Safety line passes through the eye of each bridle leg and is attached above the headache ball or to the crane hook	☐ Yes	☐ No
15.	Hook throat opening has been closed by pinning, bolting, or mousing safety latch	☐ Yes	☐ No
16.	Rigging is dedicated for platform use and is not used for any other purpose when not hoisting personnel	☐ Yes	☐ No
PLATFORM REQUIREMENTS			
17.	Platform is posted with its weight and rated load capacity or maximum intended load	☐ Yes	☐ No
18.	A grab rail is installed inside the entire perimeter of the platform	☐ Yes	☐ No
19.	Access gates, if installed, do not swing outward and have a device to prevent accidental opening	☐ Yes	☐ No
20.	In addition to hard hats, employees are afforded overhead protection by the platform when exposed to falling objects	☐ Yes	☐ No
21.	All edges exposed to employee contact are smoothed to prevent injury from punctures or lacerations	☐ Yes	☐ No
PLATFORM LOADING			
22.	The platform is not loaded in excess of its rated capacity	☐ Yes	☐ No
23.	The number of employees does not exceed the number required for the work to be performed	☐ Yes	☐ No
24.	The platform is not used to hoist tools or materials except for those necessary for employees to perform the work	☐ Yes	☐ No
25.	Personnel, tools, and materials are evenly distributed within the platform	☐ Yes	☐ No

PROOF-TESTING, TRIAL LIFT, AND INSPECTION

26. The platform and rigging has been proof tested to 1.25 times the rated capacity (minimum duration, 5 minutes) ☐ Yes ☐ No
27. After proof testing, the platform has been inspected for deficiencies ☐ Yes ☐ No
28. 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). ☐ Yes ☐ No
29. 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. ☐ Yes ☐ No

OTHER

30. Tag lines are attached and ready for use, or a determination has been made that the use of tag lines creates an unsafe condition ☐ Yes ☐ No
31. A pre-lift meeting with all affected employees has been conducted ☐ Yes ☐ No
32. There is no adverse weather condition, winds are less than 15 mph, and there is no electrical storm activity or heavy rain ☐ Yes ☐ No
33. Employees will remain in continuous sight of and in communication with the operator or signal person. If radios are used, they have been tested ☐ Yes ☐ No
34. Employees have been tied off with full body harness above the headache ball, or to the load block ☐ Yes ☐ No

Remarks:

Crane Inspector:

Print Name | Signature | Organization | Date

Site Safety Representative:

Print Name | Signature | Organization | Date

Project Manager:

Print Name | Signature | Organization | Date

S3NA-310-FM2 Critical Lift Checklist

A critical lift is any lift that exceeds 75% of the crane's rated capacity, involves more than one crane, involves unusual or severe hazards, or any lift the PM identifies as Critical.

ADMINISTRATIVE INFORMATION:	
PROJECT NAME:	
PROJECT MANAGER (PM):	**DATE:**
SUBCONTRACTOR NAME:	**SUBCONTRACTOR PM:**
SUPERVISOR IN CHARGE:	**CRANE OPERATOR:**
SIGNAL PERSON 1:	**SIGNAL PERSON 2:**

CRITICAL LIFT REQUIREMENTS:

1. LIFT CONDITIONS:

a. Crane pad level, firm & stable ☐ Yes ☐ No
b. Has longest lift radius been identified ☐ Yes ☐ No
c. Have special hazards been identified ☐ Yes ☐ No
   i. Power lines ☐ Yes ☐ No
   ii. Obstructions in lift path ☐ Yes ☐ No
   iii. Location of utilities and structures ☐ Yes ☐ No
   iv. Weather conditions ☐ Yes ☐ No
d. Has a lift sequence been established and reviewed ☐ Yes ☐ No
e. Are personnel clear of lift area ☐ Yes ☐ No

2. LOAD CONDITIONS:

a. Is exact load weight known ☐ Yes ☐ No _____Pounds
b. Is weight of rigging known ☐ Yes ☐ No _____Pounds
c. Is the weight of the load block and line known ☐ Yes ☐ No _____Pounds
d. Has the center of gravity of the load been established ☐ Yes ☐ No
e. Is rigging adequate and in good condition ☐ Yes ☐ No

3. COMMUNICATIONS:

a. Have hand signals been reviewed ☐ Yes ☐ No
b. Has location of spotters been established ☐ Yes ☐ No
c. If radios are used: ☐ Yes ☐ No
   i. Have they been tested from location of use ☐ Yes ☐ No
   ii. Is frequency clear of other radio traffic ☐ Yes ☐ No

4. CONDITION OF CRANE (CHECKED BY OPERATOR):

a. Is pad blocking adequate and substantial ☐ Yes ☐ No
b. Is the crane level ☐ Yes ☐ No
c. Are ropes and pendants in good condition ☐ Yes ☐ No
d. Are adequate parts of line being used ☐ Yes ☐ No
e. Is line revved properly ☐ Yes ☐ No
f. Are controls in good working condition to insure smooth operation ☐ Yes ☐ No
g. Is the load within chart limits for the above conditions ☐ Yes ☐ No

h. What is the boom length .....

i. What is the maximum boom angle .....

j. What is the maximum load radius .....

5. PRE-LIFT MEETING:

Has a pre-lift meeting been conducted with all persons involved to review this information ☐ Yes ☐ No

6. LIFT DIAGRAM (INCLUDE CRANE SETUP, RADIUS, LOAD, ETC.):

APPROVAL SIGNATURES:	
SUBCONTRACTOR SUPERVISOR IN CHARGE:	SUBCONTRACTOR PM:
AECOM PROJECT MANAGER:	AECOM SAFETY REPRESENTATIVE:

S3NA-406-PR Electrical Lines, Overhead

1.0 Purpose and Scope

1.1 Provides the safe work requirements to be observed where overhead power lines are present on a job site.

1.2 This procedure applies to all AECOM North America-based employees and operations.

2.0 Terms and Definitions

2.1 Types of overhead lines:

2.1.1 Overhead power lines

2.1.2 Structural cable supports

2.1.3 Guy wires

2.1.4 Cable television / communication lines

3.0 Attachments

3.1 S3NA-406-FM Overhead Electrical Lines Acknowledgement Form

4.0 Procedure

4.1 An appropriate distance must be kept between equipment and overhead utility lines.

4.2 **Employees** must contact the power line operator before work is done or before equipment is operated within 15.25 metres (50 feet) of an energized overhead power line, in order to:

4.2.1 Determine the voltage of the power line, and

4.2.2 Establish the appropriate safe limit of approach distance as identified by provincial/territorial regulations.

4.3 The safe limit of 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 4.15 metres (13.5 feet).

4.4 **Employers** or **Project Managers** must formally notify (using the *S3NA-406-FM Overhead Electrical Lines Acknowledgement form*) all subcontractors or equipment operators of an energized overhead power line before work is done or equipment is operated in the vicinity of the power line at distances less than the safe limit of approach distances and obtain the operator's assistance in protecting workers involved.

4.5 **Employees** must not place earth or other material under or beside an overhead power line if doing so reduces the safe clearance to less than the safe limit of approach distances.

4.6 To maintain minimum safe clearances:

4.6.1 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).

4.6.2 Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.

4.6.3 Position signs or other devices to determine the “Danger Zone.”

4.6.4 Inform all on-site staff with the on-site clearances required.

4.6.5 Beware of atmospheric conditions, such as temperature, humidity, and wind, that may dictate more stringent safety procedures.

4.7 Operation of heavy equipment and cranes in areas with overhead power lines represents a significant hazard to all personnel on the job site. Accidental contact with an energized line or arcing between a

high power line and grounded equipment can cause electrocution of equipment operators or nearby ground personnel, and damage to power transmission and operating equipment. Although maintaining a safe distance from all energized lines is the preferred means for control of this hazard, site conditions may not always accommodate this. If work will (or may) occur within 50 feet of any energized line, the procedures outlined below will be observed.

4.8 Overhead power lines will be identified on each job site before the work commences. For each identified line, the **Project Manager** must determine whether it is energized (and the operating voltage for energized lines), and whether work operations will require that activities with heavy equipment (excavators, loaders, cranes, etc.) will occur within 50 feet (15.25 metres) of the line. Unless verified, it will be assumed that all lines are energized.

4.9 Safe working distance is the minimum distance that must be maintained between any energized electrical line and any part of the operating equipment to maintain adequate safety margins and is based on the line voltage of the power line. Figure 4-1 lists the line voltages in kilovolts and the Minimum Safe Work Distance in the United States and Figure 4-2 indicates the Nominal Phase to Phase voltage rating in kilovolts for Canada. The following safe working distance criteria will be applied for all AECOM operations:

Figure 4-1: United States Overhead Line Criteria

Line Voltage (Kilovolts)	Minimum Safe Working Distance
0 – 50	10 feet
>50 – 200	15 feet
>200 – 350	20 feet
>350 – 500	25 feet
>500 – 750	35 feet
>750 – 1,000	45 feet

Source: American National Standards Institute, Publication B30.5.

Figure 4-2: Canadian Overhead Line Criteria

Column 1	Column 2
Nominal phase-to-phase voltage rating	Minimum Distance
Over 425 to 12,000	3.0 metres
Over 12,000 to 22,000	3.0 metres
Over 22,000 to 50,000	3.0 metres
Over 50,000 to 90,000	4.5 metres
Over 90,000 to 120,000	4.5 metres
Over 120,000 to 150,000	6.0 metres
Over 150,000 to 250,000	6.0 metres
Over 250,000 to 300,000	7.5 metres
Over 300,000 to 350,000	7.5 metres
Over 350,000 to 400,000	9.0 metres

Source: Canada Occupational Health and Safety Regulations Electrical Safety- Subsection 8.5(6).

4.10 Under no circumstances will any object pass closer than 3 metres to any energised, uninsulated electrical line.

4.11 Formally notify all subcontractors of Overhead Power lines with the attached *S3NA-406-FM Overhead Electrical Lines Acknowledgement* form.

4.12 Acceptable Safety Procedures

4.12.1 Where any work task will not allow the minimum safe working distance to be maintained at all times, an alternate means of protection must be identified and approved by the **SH&E Department.** In order of preference, acceptable procedures are

- De-energize the power line(s)/lockout by local utility authorities
- Install insulated sleeves on power lines
- Assign line spotters to assist the equipment operator

4.12.2 De-energize Power Lines

- Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site power lines are 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 owner of the line (generally the local electrical utility). Therefore, de-energizing of a line requires advance coordination with the line owner; generally, at least one week advance notice should be provided.

4.12.3 Install Insulating Sleeves

- Insulating sleeves can be placed over power lines to provide a contact and arcing barrier if work must occur closer to the power lines than the accepted safe work distance. Although not as desirable as line de-energizing, the use of these sleeves can provide an acceptable alternative where electrical lines are required to remain in service.
- As with de-energizing of distribution and transmission lines, placement of insulating sleeves can be performed only by the line owner. This requires advance coordination with the line owner; generally, at least one week advance notice should be provided. To install the sleeves, representatives of the line owner will require access to the job site.

4.12.4 Assign Line Spotters

- A line spotter is a person located at ground level who is assigned to observe equipment operations, with the specific duty of assisting the equipment operator to ensure that no part of the equipment gets too close to an energized, unprotected electrical line.
- Persons assigned to act as line spotters must meet the following requirements:
    - While acting as a line spotter, no other duties may be performed (e.g., the line spotter cannot also act as the load spotter during a lifting operations).
    - The spotter will have a radio or other direct means of communicating with the equipment operator at all times.
    - The spotter will be positioned at a right angle to the equipment operator's line of sight to maximize the sight angles between the personnel.

Under no circumstances will any portion of a piece of equipment pass closer than 10 feet to any energized, uninsulated electrical line.

4.13 Additional Safety Measures

4.13.1 The following additional safety measures can 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 in Section 4.1.

4.13.2 If an electrical power line is hit or an electrical arc occurs:

- All ground personnel must evacuate IMMEDIATELY to a distance of at least 50 feet (15.25 metres). DO NOT attempt to rescue any injured person until the line can be de-energized.
- The operator should remain in the cab until the line can be de-energized and should carefully try to extricate the equipment from the power line. This may not be possible where melting of insulator material or metal has occurred.
- Contact the line owner to report the line contact and request that the line be de-energized immediately.
- Once the line has been confirmed to be de-energized, the operator can safely evacuate the cab and rescue can commence for any injured personnel.
- Contact the **SH&E Department** to report the incident and implement any instructions provided.
- If the operator must evacuate while the line is still energized (because of fire or other life-threatening condition) he/she should jump clear of the equipment (making sure to avoid touching the equipment and the ground simultaneously), and land upright and with feet together. Once on the ground, proceed in a direct line away from the equipment using a short, shuffling gait (feet touching, sliding each foot no more than 1 foot forward at a time) to minimize shock hazard from electrical energy being transmitted through the ground.

5.0 Records

5.1 None

6.0 References

6.1 None

S3NA-406-FM Overhead Electrical Lines Acknowledgement

Company information		
Name of Employer or Contracting Operation:		
Address:		
City:	**Province:**	**Postal Code:**
Telephone:	**Fax:**	
Project name:		
AECOM contact name:		
Acknowledgement		
I acknowledge that I have received a copy of the *S3NA-406-PR Electrical Lines, Overhead*, I understand that this project site may have Overhead Electrical Hazards, and I have discussed this procedure with all of our company staff who will be on this site.		
Name and Title (Print)	**Signature**	**Date**

S3NA-410-PR Hazardous Energy Control

1.0 Purpose and Scope

1.1 Establishes the requirements for AECOM employees to perform hazardous energy control (equipment lockout and tagout (LOTO)) operations.

1.2 This procedure applies to all AECOM North America 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 lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed

2.2 **Authorized Employee:** A person who locks out or tags out a machine or piece of equipment in order to perform servicing or maintenance on that machine 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:** Any electrical, mechanical, hydraulic, pneumatic, chemical, radiation, thermal, or compressed gas energy source; 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 **Energy Source:** Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

2.8 **Isolation:** A physical activity using a device which 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.

2.9 **Locking Device:** A device that utilizes a lock, key, and identification number to hold an energy isolation device in the safe position for the purpose of protecting personnel.

2.10 **Lockout:** The use of a locking device to ensure that an energy-isolating device and the equipment it controls cannot be operated until the lockout device is removed.

2.11 **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 how lockout/tagout will be performed.

2.12 **Normal Production Operations:** The utilization of a machine or piece of equipment to perform its intended production function.

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:** The use of a warning device to establish that an energy-isolating device and the equipment it controls may not be operated until the tagout device is removed.

3.0 Attachments

3.1 S3NA-410-FM1 Lock and Tag Removal Form

3.2 S3NA-410-FM2 LOTO Verification Checklist

3.3 S3NA-410-FM3 Emergency Lock Removal Form

3.4 S3NA-410-TP Equipment-Specific LOTO Procedure Template

3.5 S3NA-410-ST Hazardous Energy Control

4.0 Procedure

4.1 Region and District operations managers

4.1.1 Provide LOTO training to employees engaged in projects covered by this procedure

4.1.2 Assure that **Project Managers** are preparing and implementing LOTO procedures on their projects

4.2 **Project Manager** or **Resident Engineer** on the project is responsible for administering the procedure including:

4.2.1 Determining whether client employees or AECOM employees will be responsible for implementing any required lockout/tagout of energy sources at client facilities

4.2.2 Consulting with the SH&E Department regarding project specific requirements for lockout/tagout

4.2.3 Informing the field team about the client or facility's requirements for lockout

4.2.4 Ensuring that if AECOM is responsible for lockout/tagout, that only authorized employees work on or near equipment requiring hazardous energy control

4.2.5 Assuring that the written LOTO procedure in effect on a project is audited at least annually including the observation of workers performing the procedure

4.3 Supervisors

4.3.1 Assure that all **employees** under their direction are fully aware of, understand, and adhere to the Lockout/Tagout procedures.

4.4 Authorized Employees

4.4.1 Verifying with the **Project Manager** who is responsible for LOTO at client facilities.

4.4.2 Obtaining a lock, key and tags.

4.4.3 Meeting with the facility representative and affected employees to review the LOTO activities.

4.4.4 Implementing project specific LOTO procedures.

4.5 Affected Employees

4.5.1 Assist **Authorized Employees** with the safe shutdown and restart of equipment.

4.5.2 Assure that no attempt is made to restart equipment without the knowledge of all employees performing work on the equipment.

4.6 All Employees

4.6.1 Refrain from making any attempt to restart equipment that is locked or tagged out.

4.6.2 Avoid areas where other **employees** are working on equipment.

4.7 Training

4.7.1 The supervisor must orientate all personnel to the project, the hazards associated with the work to be performed and the Lockout/ Energy Control Procedures to be followed.

4.7.2 Proof of training must be documented on the Project Safety Plan and readily available for review.

4.8 General Procedures

4.8.1 Energy control means to neutralize and make inoperable all potential sources of energy or power in the equipment or machinery to be worked on. No part of the equipment should be capable of inadvertent activation or movement, which may lead to personal injury. Removing a fuse, closing a valve or turning a switch is not an acceptable isolation from the energy source.

4.8.2 Only staff orientated to the lockout/energy control procedure will be involved with the locking out, de-energizing and control of all potential sources of energy on energized systems.

4.8.3 Written procedures for lockout and energy control shall be developed and approved by the Site Supervisor or Client and must be implemented prior to performing work.

4.8.4 The site, project or Client specific procedures must be understood and followed for the health and safety of all workers 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.

4.8.5 Be aware of all potential energy sources, such as:

- Chemical
- Hydraulic
- Radiological
- Electrical
- Mechanical
- Residual
- Gravitational
- Pneumatic
- Thermal
- X-ray testing of pipes

4.8.6 It is the responsibility of on-site supervisors to identify through meetings with Client representatives when and where their work requires the isolation and control of an energy source.

4.8.7 The supervisor must also identify and communicate to all on-site personnel how the sources of energy will be isolated, brought to a zero energy state, locked out of service and tested to verify the effectiveness of the controls.

4.8.8 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.

4.8.9 Padlocks and Danger Tags

- Where there is a danger of equipment being energized, the motor switch on all individual motor drives shall be locked in the open position.
- It shall be the responsibility of each employer to maintain an adequate supply of safety locks.
- Each worker affected shall affix their own individual lock.
- In addition, a danger tag shall also be applied to the lockout bearing: a brief description of the work being done; the company name, the worker's name, the supervisor's name, the date and emergency phone numbers.
- The tag and locks shall remain in place until the work has been completed.
- Where a lock has been abandoned or must be removed due to an emergency, the Site Supervisor or Client contact must be notified and the removal must follow the approved lock abandonment procedure.

4.8.10 LOTO of energy sources must be performed only by an **Authorized Employee**. If more than one employee is involved, either each individual **Authorized Employee** must use his/her own lock (multiple lockout), or a group lockout may be performed by the **employees'** supervisor/foreman.

4.8.11 The locks, tags, and equipment shall not be tampered with by any employee.

4.8.12 Only the person placing the lock and tag the equipment may remove the lock and tag.

4.8.13 If the **employee** who placed the lockout/tagout device/sign subsequently no longer works for the company, or cannot be located, only the authorized supervisor/foreman can remove the locks and tags in accordance with the procedure outlined below for Removal of Unattended Lockout/Tagout Devices.

4.9 Authorized Employees

4.9.1 Only **employees** that have completed training for Lockout/Tagout **Authorized Employees** will be permitted to perform work under Lockout/Tagout procedures.

4.9.2 Each **Authorized Employee** will also be responsible for reviewing any applicable equipment-specific Lockout/Tagout procedure prior to initiating work.

4.9.3 Any problems identified with the equipment-specific procedure are to be immediately reported as an incident or near miss and should be brought to the attention of the SH&E Department and all work on affected equipment halted.

4.10 Shift Change Procedures

4.10.1 If ongoing work requires carryover from shift to shift, or transfer of responsibility between **employees**, the following procedure will be implemented:

- The **employee**(s) who originally performed the lockout shall walk through the lockout/isolation steps with the new worker.
- At each isolation point the original worker shall remove his/her lockout/tagout device(s), to be immediately replaced by the new worker's device(s).
- Upon transfer of the lockout/tagout equipment, the new employee shall verify that the equipment is still isolated prior to continuation of work.

4.10.2 Under no circumstances shall the original devices remain in place and just the keys transferred.

4.10.3 For supervisor/foreman and/or group lockouts, the same procedure shall be used with the oncoming supervisor/foreman.

4.11 Removal of Unattended Lockout/Tagout devices

4.11.1 Only the person(s) who placed the lockout/tagout devices on the system can remove the devices, unless:

- The **Project Manager** has verified that the 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 employee to verify that the work is complete and the devices are about to be removed.
- The **Project Manager** inspects the locked-out/tagged-out device and ensures that the equipment is capable of being safely re-energized.

4.11.2 If all of the above apply, the locks and tags can be removed at the direction of the Project Manager. The Project Manager shall complete an *S3NA-410-FM1 Lock and Tag Removal Form* to document the event prior to removing the lock and file the form with the project records. A copy of the form shall be sent to the SH&E department member with oversight responsibility for the project.

4.11.3 **UNAUTHORIZED REMOVAL OF A LOCKOUT/TAGOUT DEVICE WILL RESULT IN IMMEDIATE DISMISSAL FROM THE PROJECT SITE AND POTENTIAL TERMINATION!**

4.12 Emergency Lock Removing Procedures

4.12.1 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.

4.12.2 In an emergency event that requires a lock or tag to be removed by a person other than the person who placed the lock or tag, the following lock-removing procedure will be implemented by another Authorized Employee:

- Investigate and verify that all equipment and material in relation to the work has been completed and/or put into a safe configuration.
- Ensure all personnel have been removed from the hazardous location and Affected Employees on site are notified.
- Remove lock.
- Attempt to contact the person that originally provided LOTO to advise him that the LOTO has being removed.
- Complete the *S3NA-410-FM3 Emergency Lock Removal Form*. The Emergency Lock Removal Forms will be placed in the project files and send a copy to the SH&E department member with oversight responsibility for the project.
- Whenever a LOTO is removed for emergency purposes by anyone other then the employee who placed the LOTO, that person and all affected personnel must be contacted prior to the start of their next shift to inform them that the equipment/system is no longer locked out/tagged out.

4.13 Specific LOTO Procedures

4.13.1 Written procedures will be developed for the lockout and tagout of each piece of equipment that has potentially hazardous energy sources (*S3NA-410-TP Equipment-Specific LOTO Procedure Template*).

4.13.2 Each procedure must be reviewed and approved by the SH&E Department prior to implementation.

4.13.3 Equipment-specific written lockout/tagout procedures are not required, if ALL of the following conditions are met:

- The equipment's only energy source is electrical; and
- 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.

4.13.4 Additionally, equipment-specific Lockout/Tagout 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); and,
- The machine has a single energy source that can be readily identified and isolated (if more than one energy source is present (e.g., gas and electric), then written procedures shall be developed); and,
- The isolation and locking out of the single energy source completely de-energizes and deactivates the equipment; and,
- Servicing of the machine requires that its energy source must previously have been locked out and tagged out in accordance with this section; and,
- A single lock-out device achieves a locked-out condition.

4.13.5 Procedure Outline. All equipment-specific Lockout/Tagout procedures will be prepared to meet the following steps:

- Identify type and magnitude of energy.
- Notify affected employees that the machine/equipment will be shut down and locked out for servicing.
- Shut down machine/equipment by normal stopping procedure.
- Identify all energy-isolating device(s) for the machine or equipment being serviced.
- Lock out each device with individual locks. Tag out only if a device is not capable of being locked out.
- Relieve or restrain stored and/or residual energy.
- Verify the isolation of equipment and its zero energy state (attempt to restart the equipment.)
- Establish that energy to the equipment being worked on was isolated.

- Complete *S3NA-410-FM2 LOTO Verification Checklist LOTO Verification Checklist.*
- Perform work.
- Check work area to remove non-essential items and ensure equipment components are intact.
- Check work area to ensure all personnel are removed from the area.
- Verify that the controls are in neutral (off).
- Remove lockout device(s).
- Notify affected employees that the machine/equipment is ready for use.
- Reenergize the machine or equipment.

4.14 Non-Specific LOTO Procedures

In the absence of an equipment-specific LOTO procedure, the following procedures, in combination with a completed Task Hazard Analysis (or Job Safety Analysis), can be used as an acceptable substitute.

4.14.1 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., presses, elevated vehicles).
- Determine which of these sources requires isolation to perform the work.
- Determine the locations where each energy source for that 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. You must then either unplug the equipment or find, close, and lock out the circuit breaker or electrical switch supplying the machine.
- Make sure anyone in the area knows you are about to turn off and lock out the equipment, and then close the isolation devices. Once closed, lock out the isolation devices so they cannot be inadvertently opened.
- Place an appropriate tag on each lock out device, with the appropriate warning (e.g., Do Not Open, Do Not Start) with date and time of isolation and a means of identifying who has performed the lockout.
- Once everything is locked out, verify that the isolation was successful by following manufacturers' directions or standard trade practice. Means of determining whether isolation was successful include:
  - Try to turn the equipment on.
  - Use pressure relief valves.
  - Try to ignite the pilot light.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist LOTO Verification Checklist*
- Perform the necessary work.
- Ensure all tools and parts are removed from the work area.
- Remove the tags and locks 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 personnel in the area that the lockout/tagout systems have been removed.
- If additional work is required (e.g., repair of leak, fine tuning of work), the lockout/tagout procedure must be re-established. Under no circumstances shall work be performed on the equipment without prior isolation of the energy sources.

4.14.2 High Voltage Electrical Systems

In general, AECOM personnel will provide lockout/tagout services in low voltage situations only (voltage is below 600 volts). For high voltage situations (above 600 volts), AECOM will either subcontract operations to an electrical subcontractor or obtain approval of the equipment-specific Lockout/Tagout procedure from the Group SH&E Manager and the Regional Manager. If an electrical subcontractor is utilized, they will be required to provide documentation of their high voltage certification.

4.14.3 Low Voltage Procedure

- Make sure the equipment to be worked on is turned off.

- Locate the source of the electrical supply and isolate the equipment. This can be accomplished by:
  - Turning the appropriate circuit breaker off.
  - Unplugging the equipment.
  - Disconnecting the source from the battery (e.g., pulling cables from automotive batteries).
- Lock the isolation circuit in the closed position using an appropriate locking device and a unique lock and key system.
- Tag the locked-out circuit. The tag used shall warn against the hazard (e.g., Do Not Start), and include a means of identifying the employee who installed the tag and lock.
- Go back to the equipment and try to turn it on to ensure that the proper source has been isolated. If the machine turns on, reverse the above steps (b-d), and start again until the proper circuit is isolated. Report the incident to site safety coordinator as a serious near miss and do not perform the task until proper isolation is performed and verified. The site (project) manager is responsible for developing the written procedure for LOTO of this equipment prior to authorizing re-work on it.
- Complete the LOTO Verification Checklist.
- Perform the required work.
- Upon completion of the work, inspect the area to ensure all tools and parts are removed. If tools or parts are noticed after the energy source is no longer locked out, steps (a-e) MUST be performed again prior to retrieval of the tools/parts. Under no circumstances shall the items be retrieved without the equipment being locked out.
- Inform anyone in the area that work has been completed and equipment is being energized.
- Remove the tag and lock.
- Turn on the closed circuit following the appropriate procedures (or reconnect the battery cables).
- Turn the equipment on to verify operation.

4.14.4 Pressurized Water or Air/Gas

- Turn the appropriate valve upstream from the area of work to the off position (closed). Note: if steam or water can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or ensure that all necessary valves have been closed to stop all fluid or steam flow into the section to be worked. 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) must be established on both sides prior to authorizing confined space entry.
- Using the appropriate device, lock the valve(s) in the closed position using a unique lock and key.
- Tag the locked-out valve(s). The tag shall warn against the hazard (Do Not Open) and include date and time of isolation and a means of identifying the employee who installed the lock and tag.
- Allow the system to be worked to cool down (in the case of steam or hot water).
- Relieve the pressure in the system and then drain any fluid 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 bled to atmospheric pressure, the pipes or lines shall be disconnected, blinded, or closed by a valve and locked out and/or tagged accordingly. Observe line entry procedures when first opening the line.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist*.
- Perform the necessary work.
- Ensure all sections are secure and closed.
- Remove the tag and lock.
- Slowly open the valve, stopping when water or steam flow has started. Observe the work performed to make sure no leaks are evident. If there are no leaks, then the valve can be completely opened. If leaks are observed, then re-close the valve, and follow steps 2-5 above to reapply the LOTO to the system.

4.14.5 Natural Gas Lines

- Turn off the valve upstream from the area to be worked.

- Using the appropriate device, lock the valve in the closed position using a unique lock and key.
- Ensure all spark sources in the area have been isolated or removed.
- Using non-sparking tools, 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 must be locked out and tagged out.
- Complete the *S3NA-410-FM2 LOTO Verification Checklist*.
- Perform the required work. If hot work is necessary (i.e. soldering, grinding, welding), make sure the line has been purged of gas and that the hot work requirements of this manual are followed, including explosivity check prior to authorizing work.
- Make sure that all connections are secure. Also, have a solution of soap and water for leak testing.
- Remove all tools and parts from the area.
- Remove the lock(s) and tag(s) from the valve(s).
- Slowly crack open the valve(s).
- Test the work area for leaks using the soap solution. If leaks are detected, the system must be locked out and tagged out following steps 1-4 above before additional repairs can be made.
- If no leaks are detected, gradually open the isolation values to their normal position.

4.15 Annual Program Review

4.15.1 At least annually (or whenever any incident or serious near miss occurs due to inadequate lockout/tagout) , an independent Authorized Employee who is not involved in the procedure being inspected must conduct and document a review and inspection of the Energy Control Program specific to the identified facility. The inspection should include a meeting with authorized employees and any other affected employees.

4.15.2 The inspection procedure must include the following elements.

- Where lockout is used, discuss the authorized employee's responsibilities under the lockout/tagout program with the inspector.
- Hold group meetings with the authorized employees who are performing the inspection and all authorized employees who implement the procedure.
- Where tagout is used, discuss the authorized employee's responsibilities under the lockout/tagout program and the limitations of the tagout system.
- Review of lockout/tagout verification checklists and other documentation to ensure procedure is being correctly followed and documented.
- If deficiencies are noted during the inspection, corrective actions and retraining of employees, as necessary, must be performed immediately.
- The inspector shall provide a copy of all inspection documentation to the applicable AECOM Manager for review and filing.

These inspections shall at least provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These inspections are intended to ensure that the energy control procedures are being properly and consistently implemented.

4.16 Training

4.16.1 Authorized Employees

Authorized Employees involved in or affected by lock out and their Supervisors and **Project Managers** will be trained in the following areas before being allowed 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;
- Purpose and use of the energy-control (lock out/tag out) procedure, equipment, and devices;
- 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 lock out/tag out procedures.

Authorized Employees are limited to those departmental supervisors and managers, and those selected employees who have successfully completed all of the required training listed above.

4.16.2 Affected Employees

Affected Employees will be trained in the purpose and use of the lock out/tag out procedure. All employees whose work operations may be in an area where lock out/tag out 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.

4.16.3 Retraining

Retraining or refresher training for Authorized 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;
- An inspection reveals deviations from the standard procedures or inadequacies in the employee's knowledge or use of the lock out/tag out procedure;
- An incident occurs as a result of unexpected energy release.

4.16.4 Training Documentation

All employee training, including refresher training, will be documented in accordance with *S3NA-003-PR 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 Authorized and Affected employees above.

5.0 Records

5.1 None

6.0 References

6.1 None

S3NA-410-FM1 Lock and Tag Removal Form

TAG NUMBER	LOCK NUMBER	LOCATION USED	COMPONENT AFFECTED	DATE/TIME ATTACHED	MANAGER / SUPERVISOR	DATE/TIME RETURNED

S3NA-410-FM2 LOTO Verification Checklist

Equip ID (#)/Loto Location (S)—Device Type and Number:	Date:
Loto Reference Number:	

Lockout-Tagout Checklist	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.)?			
Deactivating Energy-Isolating Device Have all energy-isolating devices been deactivated so that the machine/equipment is isolated from all energy sources?			
Lockout Has a lock been placed on all appropriate energy isolating devices with an assigned individual lock(s)?			
Tagout Has a tag been placed on all appropriate 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 are operationally intact?			
Personnel Verification Have all personnel been safely positioned or removed from the area and all controls are in neutral?			
Lockout Removal And Equipment Startup Has all lockout and tagout devices been removed and the machine reenergized?			
Employee Notification Have all affected been notified that the LOTO is complete and that the machine/equipment is ready for use?			

NOTES:

S3NA-410-FM3 Emergency Lock Removal Form

This form will only be used 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.

1. NAME of personnel whose LOTO is to be removed:			
2. METHOD(s) used to contact personnel whose LOTO is to be removed:			
3. LOCATION of LOTO:			
4. REQUIRED CONTACTS: Contact the following AECOM personnel to locate affected contractor personnel:			
Contact Name 1:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 2:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 3:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 4:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**

5. NOTIFICATION:

An AECOM representative has been contacted. ☐ Yes ☐ No

Notification verified by: (Initial) 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. ☐ Yes ☐ No

Notification verified by: (Initial)

	Print Name	**Signature**	**Date**
Project Manager			
SH&E Representative			

AFTER COMPLETION OF THESE STEPS, THE LOCK AND TAG MAY BE REMOVED

This form must be provided to the AECOM Project Management Team (PM and SSO) so the affected employee can be notified that his/her Lock-Out/Tag-Out has been removed

S3NA-410-TP Equipment-Specific LOTO Procedure Template

PROCEDURE REFERENCE NUMBER:

EQUIPMENT:	
EQUIPMENT NO:	**LOCATION:**

PURPOSE

This 7-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.

COMPLIANCE WITH THIS PROCEDURE

All employees are required to comply with the restrictions and limitations imposed on them during the use of this procedure. The 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.

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 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

___ Electrical (440V)	___ 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. Deactivate the energy isolating device(s) so that the equipment is isolated from the energy sources(s).

   Specific Instructions:

5. 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.

S3NA-410-ST Hazardous Energy Control

Jurisdiction	Regulation
United States	
OSHA	29 CFR 1910.147, Control of Hazardous Energy
Canada	
Alberta	OHS Code (2009) Sect 212 – 215.5
British Columbia	OHS Regulation (1997) Sect 10.1 – 10.12
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 16.14 – 16.18
New Brunswick	OHS Regulation (91-191) Sect 287.3 – 287.6, 292
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 73, 85
Nova Scotia	OHS Regulation (N.S. Reg. 44/99) Sect 52 – 54
NWT/NU Territories	General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 143 – 149
Ontario	O. Reg. 851 Sect 41 – 42.1
Prince Edward Island	OHS Regulations (EC180/87) Sect 3.01 – 3.10
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 185
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 139
Yukon Territory	OHS Regulations (O.I.C. 2006/178) Sect 9.12 – 9.17

The following standards apply to lockout and energy control:

Association	Standard
Canadian Standards Association (CSA)	CAN/CSA-Z460-05, Control of Hazardous Energy - Lockout and Other Methods

S3NA-506-PR Compressed Gases

1.0 Purpose and Scope

1.1 This procedure provides the requirements for using, handling, storing, transporting, disposition and/or decommissioning compressed gas cylinders in accordance with 29 CFR 1910.

1.2 This procedure applies to all AECOM North America based employees and operations.

2.0 Terms and Definitions

2.1 **Compressed Air (Non-Breathable)**: Air that is at a pressure greater than that of the atmosphere. Compressed air shall not be used for cleaning purposes except where reduced to less than 30 psi and then only with effective chip guarding and personal protective equipment**.** Utilized for tools, equipment, and mechanical machinery and cleaning purposes as described in this procedure.

2.2 **Compressed Gas:** Any material or mixture in a pressure vessel having:

- An absolute pressure exceeding 40 pounds per square inch (PSI) at 70°F (25 pounds per square inch gauge); or
- An absolute pressure exceeding 104 Psia at 130°F, regardless of the pressure at 70°F.

2.3 **Cylinder**: Pressure vessel designed for pressures higher than 40 Psia and having a circular cross section.

2.4 **Pneumatics**: The use of pressurized air to affect mechanical motion for machinery, equipment and tools.

2.5 **Psi**: Pounds per square inch.

2.6 **Psia**: Pounds per square inch absolute (i.e., pressure in a container that would appear on an ordinary gauge plus the local atmospheric pressure [14.696 psi at sea level]), psig- pounds per square inch gauge.

2.7 **Psig**: Pounds per square inch gauge. The pressure in a vessel or container as registered on a gauge attached to the container. This reading does not include the pressure of the atmosphere outside the container.

2.8 **Disposition**: Recycling, treatment, or disposal of a compressed gas cylinder and/or its contents.

2.9 **Decommission**: The removal of a compressed gas cylinder from service by rendering it permanently unusable.

3.0 Attachments

3.1 S3NA-506-FM Cylinder Inspection

3.2 S3NA-506-ST Compressed Gases

3.3 S3NA-506-WI Compressor Safety Card

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Project Manager

- Implement these procedures during all activities involving compressed gases.
- Seek consultation with the SH&E Department when unknown compressed gas cylinders are encountered.
- Confirm staff has received the appropriate training as it relates to compressed gases/compressed gas cylinders.
  - Confirm a hazard assessment/evaluation of the activities involving compressed gases has been completed.
  - Contact the SH&E Department prior to any compressed gas cylinder operation.

4.1.2 Region SH&E Manager

- Review and authorize all compressed gas cylinder operations.
- Conduct/support compressed gas hazard assessments/evaluations.
- Provide awareness training to project teams regarding hazards of encountered compressed gases.
- Support the identification/disposition of unknown compressed gas cylinders.
- Support the development of a site-specific cylinder plan.

4.1.3 Supervisor

- Immediately report any leaking/suspected leaking compressed gas cylinder(s) to the SH&E Department and implement the appropriate emergency action(s).
- Immediately report the discovery of any unknown compressed gas cylinder(s) to the SH&E Department and cordon off the area in all directions a minimum of 50 feet.
- Confirm that all compressed gas cylinders are properly inspected, stored, and, secured.
- Confirm that all compressed gas cylinders are handled in a safe manner, protecting both the person and cylinder.
- Confirm that all compressed gas cylinder manifolds and connections are properly made and inspected.
- Contact local emergency services prior to the start of any compressed gas cylinder operation.

4.1.4 Employee

- Immediately report any leaking/suspected leaking compressed gas cylinder(s) to your immediate supervisor.
- Immediately report the discovery of any unknown compressed gas cylinders to your immediate supervisor.
- Properly handle all compressed gas cylinders.
- Staff shall be supervised by personnel experienced in the operation of compressed gas tools and equipment.

4.2 Air Compressor Operations

4.2.1 Air compressor equipment should be operated only by authorized and trained personnel.

4.2.2 The air intake should be from a clean, outside, fresh air source. Screens or filters can be used to clean the air.

4.2.3 Air compressors should never be operated at speeds faster than the manufacturer’s recommendation.

4.2.4 Equipment should not become overheated.

4.2.5 Moving parts, such as compressor flywheels, pulleys, and belts that could be hazardous should be effectively guarded.

4.2.6 Keep the air supplied tools clean and dry. Dust, moisture, and corrosive fumes can damage tools.

4.2.7 Keep tools clean, lubricated, and maintained according to manufacturer’s instructions.

4.2.8 Only use attachments and accessories recommended by the manufacturer.

4.2.9 Review the manufacturer's instruction before using a tool.

4.2.10 Post warning signs where pneumatic tools are used.

4.2.11 Set up screens or shields in areas where nearby workers may be exposed to flying fragments, chips, dust, and excessive noise.

4.2.12 Be aware of proper handling and ergonomics while using the tool.

4.2.13 Reduce physical fatigue by supporting heavy tools with a counter-balance wherever possible.

4.3 Air Hoses

4.3.1 Use the proper hose and fittings of the correct diameter.

4.3.2 Use hoses specifically designed to resist abrasion, cutting, crushing and failure from continuous flexing.

4.3.3 Choose air-supply hoses that have a minimum working pressure rating of 1035 kPa (150 psig) or 150% of the maximum pressure produced in the system, whichever is higher.

4.3.4 Check hoses regularly for cuts, bulges and abrasions. Tag and replace, if defective.

4.3.5 Blow out the air line before connecting a tool. Hold hose firmly and blow away from yourself and others.

4.3.6 Make sure that hose connections fit properly and are equipped with a mechanical means of securing the connection (e.g., chain, wire, or positive locking device).

4.3.7 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.

4.3.8 Do not operate the tool at a pressure above the manufacturer's rating.

4.3.9 Turn off the air pressure to hose when not in use or when changing power tools.

4.3.10 Do not carry a pneumatic tool by its hose.

4.3.11 Do not use compressed air to blow debris or to clean dirt from clothes.

4.3.12 All pipes, hoses, and fittings shall have a rating of the maximum pressure of the compressor. Compressed air pipelines should be identified (psi) as to maximum working pressure.

4.3.13 Air supply shutoff valves should be located (as near as possible) at the point-of-operation.

4.3.14 Air hoses should be kept free of grease and oil to reduce the possibility of deterioration.

4.3.15 Avoid trip hazards. Hoses should not be strung across floors or aisles where they are liable to cause personnel to trip and fall. When possible, air supply hoses should be suspended overhead, or otherwise located to afford efficient access and protection against damage.

4.3.16 Hose ends shall be secured to prevent whipping if an accidental cut or break occurs.

4.3.17 Pneumatic impact tools, such as riveting guns, should never be pointed at a person.

4.3.18 Before a pneumatic tool is disconnected (unless it has quick disconnect plugs), the air supply shall be turned off at the control valve and the tool bled.

4.3.19 Shop air used for cleaning should be regulated to15 psi unless equipped with diffuser nozzles to provide lesser pressure.

4.3.20 Goggles, face shields or other eye protection shall be worn by personnel using compressed air for cleaning equipment.

4.3.21 Static electricity can be generated through the use of pneumatic tools. This type of equipment shall be grounded or bonded if it is used where fuel, flammable vapors or explosive atmospheres are present.

4.3.22 The following are hazards associated with the use of compressed air tools and equipment:

- Poorly designed tool (wrist strain)
- Vibration (vibration-induced white finger)
- Noise (hearing loss)
- Dust (respiratory problems)

4.3.23 The following hazards have the potential to cause serious bodily injury when working with compressed air:

- Incorrect tool selection
- Use of damaged tool
- Improper, inadequate, or no guards
- Rotating shaft (entanglement)
- Wheel breakage (grinder)
- Flying chips
- Whipping of the hose
- Accidental start up
- Compressed air entering the body

- Dropped tool
- Tripping over hose

4.4 Compressed Air Equipment Maintenance

4.4.1 Only authorized and trained personnel should service and maintain air compressor equipment.

4.4.2 Exposed, non current-carrying, metal parts of compressor should be effectively grounded.

4.4.3 High flash point lubricants should not be used on compressors because of its high operating temperatures that could cause a fine or explosion.

4.4.4 Equipment should not be over lubricated.

4.4.5 Gasoline or diesel fuel powered compressors shall not be used indoors.

4.4.6 Equipment placed outside but near buildings should have the exhausts directed away from doors, windows and fresh air intakes.

4.4.7 Soapy water of lye solutions can be used to clean compressor parts of carbon deposits, but kerosene or other flammable substances should not be used. Frequent cleaning is necessary to keep compressors in good working condition.

4.4.8 The air systems should be completely purged after each cleaning.

4.4.9 During maintenance work, the switches of electrically operated compressors should be locked open and tagged to prevent accidental starting.

4.4.10 Portable electric compressors should be disconnected from the power supply before performing maintenance.

4.5 Compressed Gas Cylinder Requirements

4.5.1 Cylinders are not to be used unless they bear Department of Transportation (DOT) markings showing that they have been tested as required by DOT regulations.

4.5.2 Cylinders shall never be dropped, struck, or permitted to strike each other violently. Cylinders may be moved by tilting and rolling them on their bottom edges.

4.5.3 Valve protection caps shall always be kept on cylinders when they are being moved or stored, and until ready for use.

4.5.4 Do not lift cylinders by the valve protection cap.

4.5.5 Cylinder valves are to be kept closed except when gas is being used or when connected to a permanent manifold. Valves of empty cylinders shall be closed.

4.5.6 Cylinders shall never be used as rollers or supports, or for any purpose other than carrying gas.

4.5.7 Threads on regulator connections or other auxiliary equipment shall be the same as those on the cylinder valve outlet.

4.5.8 When withdrawing cylinder content, open the cylinder valve slowly. Point the valve opening away from yourself and other persons.

4.5.9 Before a regulator is removed from a cylinder, close the cylinder valve and release all pressure from the regulator. This procedure also serves as a check to confirm that the main cylinder valve is completely closed.

4.5.10 Never hammer the valve wheel in attempting to open or close the valve.

4.5.11 No person, except the owner of the cylinder or person authorized by the owner, shall refill a cylinder (*Exceptions to this includes the filling self-contained breathing apparatus cylinders with compressed air or the filling of the [Foxboro] Organic Vapor Analyzer (OVA) hydrogen cylinders*). Disposable cylinders shall not be refilled with any material after use of the original contents.

4.5.12 Cylinders of compressed gas shall be stored in areas where they are protected from external heat sources such as flame impingement, intense radiant heat, electric arc, or high-temperature steam lines.

4.5.13 Cylinders are to be stored in an assigned area, with full and empty cylinders stored separately. Empty cylinders shall be marked empty.

4.5.14 Stored fuel gases and oxygen cylinders are to be separated by at least 20 feet, or by a fire wall at least 5 feet high that has a fire-resistance rating of at least ½ hour.

4.5.15 Oxygen, nitrogen, helium, or freon cylinders shall only be stored or transported in an upright or horizontal position. Acetylene cylinders shall always be kept in an upright position. All horizontally-placed cylinders are to be secured by chocks or ties to prevent rolling.

4.5.16 Cylinders are to be secured to a fixed object by chain or equivalent fastening device whenever they are placed in an upright position. The protective cap is not to be removed or the cylinder valve opened until the cylinder is secured.

4.5.17 Repair of leaks shall never be attempted on a pressurized system. System pressure should be reduced to atmospheric pressure as rapidly as possible, and the supervisor notified immediately.

4.5.18 Compressed gas cylinders shall be legibly marked for the purpose of identifying the gas content with either the chemical or the trade name of the gas. Such marking is to be done by means of stencilling, stamping or labelling, and shall not be readily removable. Whenever practical, the marking is to be located on the shoulder of the cylinder. Positive identification of the gas in any cylinder is required before connecting cylinders for use.

4.5.19 Gas cylinders moved by hoist shall be handled in suitable cradles or job-made “skip” (materials) boxes. Any slings used for this purpose shall be specifically designed for that cylinder handling.

4.5.20 Cylinders shall not be placed where they might form part of an electrical circuit.

4.5.21 Transfer of compressed gases (including acetylene) from one cylinder to another, or mixing of gases in a cylinder, is prohibited.

4.5.22 Oxygen cylinders are never to be stored near:

- Highly combustible materials, especially oil and grease
- Reserve stocks of acetylene or other fuel gas cylinders
- Any other substance likely to cause or accelerate fire

4.5.23 Compressed oxygen is never to be used:

- As breathing air;
- To purge pipelines, tanks, or any confined area;
- To supply a head-pressure tank;
- In pneumatic tools;
- In oil preheating burners;
- To start internal combustion engines;
- For ventilation;
- For cleaning clothing; and
- In any other way as a substitute for compressed air.

4.5.24 Use of a cylinder's contents for purposes other than those intended by the supplier is prohibited.

4.5.25 Cylinders of compressed natural gas or propane equipped with a pressure relief device shall always be positioned in a manner that this device remains above the liquid level (i.e., if stored or installed horizontally on a forklift, relief device is positioned at the top).

4.6 Special Precautions for Compressed Gas Cylinders Containing Hydrogen

4.6.1 Inside buildings, cylinders of hydrogen should be separated from oxygen cylinders by a minimum distance of 20 feet or by a barrier of non-combustible material at least 5 feet high having a fire resistance rating of at least one half hour.

4.6.2 Conspicuous signs should be posted in hydrogen storage areas forbidding smoking, open flames or the use of lights or lighting not approved for use in flammable areas.

4.6.3 Although not required for gaseous hydrogen systems having a total hydrogen content of less than 400 cubic feet, it is recommended that hydrogen storage areas are labeled, "Hydrogen-Flammable Gas-No Smoking-No Open Flame" or equivalent.

4.7 Inspection of Compressed Gas Cylinders

4.7.1 Prior to formally accepting any delivered compressed gas cylinders, a visual inspection of each cylinder will be documented as specified below. In addition, all compressed gas cylinders stored at an AECOM facility will be routinely inspected.

- Visually inspect the cylinder (See *S3NA-506-FM Cylinder Inspection).*
- Verify that all the required markings are on the cylinder.
- If required, determine when the cylinder was last hydrostatically-tested.
- Inspect the safety relief devices, if required.
- If any defects are noted during the inspection, the cylinder should be refused on delivery and a new delivery requested (notify AECOM Procurement agent or Purchasing Department).

4.7.2 Where compressed gas cylinders are stored at an AECOM facility, a qualified person will be designated to confirm cylinder activities comply with the requirements in this procedure. Inspection entails the evaluation of the integrity of the cylinder as well as the serviceability of any attached manifold and valve fittings. Remote cylinder inspection is recommended for worker and public safety. The inspection of any cylinder will be conducted by a qualified person. See Attachment *S3NA-506-FM Cylinder Inspection*.

4.8 Cylinder Inspection Procedures

4.8.1 All cylinder inspection procedures will adhere to the procedures identified in CGA P-22, The Responsible Management & Disposition of Compressed Gases & Their Containers (most current edition). For valve or fitting identification, the information contained in CGA V-1, Compressed Gas Association Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connections (most current edition). At a minimum, the inspection process will include the following procedures:

- Observe the cylinder from a safe distance to identify any visual markings or other information.
- Inspect the cylinder size, shape, and general condition (if visible, include the valve system/stem in the inspection process).
- If the cylinder or valve system appears to be in poor condition or has lost structural integrity, do not approach the cylinder. Observations indicating a cylinder is in poor condition may include:
  - Leaking
  - Hissing sound
  - Odor in vicinity of the cylinder
  - Rusty components
  - Bulging side wall or end
  - Corroded valve system

4.8.2 If the cylinder is determined to be in poor condition, cordon the area off and limit access to necessary personnel only.

4.8.3 Wear applicable PPE and approach the cylinder with the appropriate direct reading air monitoring instrument (do not approach from the ends of the cylinder), then determine the airborne contaminant concentrations in the immediate area.

4.8.4 Document cylinder information (i.e., visible markings, labels, placards, etc.).

4.9 Ground Transport of Compressed Gas Cylinders

4.9.1 AECOM will transport (drive/haul) quantities of compressed gases which do not exceed Materials of Trade (MOT) quantities, whereas the transport of placardable quantities is prohibited without the proper DOT licenses/credentials and consultation with the SH&E Department.

4.9.2 Compressed gas cylinders in portable service are to be conveyed by suitable trucks, to which they are securely fastened. All gas cylinders in service shall be securely held in substantial racks or secured to other rigid structures so that they will not fall or be knocked over.

4.10 Air/Common Carrier Transport

4.10.1 All shipping of compressed gases via air/common carrier including instrument gases, regardless of quantity, shall be conducted by a qualified and trained HazMat Shipper (Level 1-2 Shipper), and shall conducted under the oversight of a designated DOT/International Air Transport Association (IATA) shipping specialist.

4.10.2 No compressed gas cylinder, regardless of contents or quantity, will be shipped via an external carrier vendor (i.e., UPS, FedEx, etc.) without the authorization of:

- **Region SH&E Manager**
- DOT/IATA shipping specialist

4.11 Cylinder Disposition & Decommissioning Activities

4.11.1 All cylinders shall be inventoried, staged, and inspected.

4.11.2 Prior to the commencement of cylinder activities, local emergency response agencies (i.e., Fire Department, Medical, and Emergency Response, if separate) shall be contacted and activities coordinated with the local agencies.

4.11.3 Air monitoring is mandatory during cylinder operations.

4.11.4 A Regional SH&E Manager shall be contacted during the planning stages of a cylinder effort in order to determine whether a site-specific cylinder plan is required.

4.11.5 A copy of the DOT Emergency Response Guidebook (most current edition) and applicable Compressed Gas Association, Inc. (CGA) guidelines shall be on site during activities.

4.12 Cylinder Color Coding Determination

4.12.1 The color coding of compressed gas cylinders is governed by the CGA, which has assigned specific colors to categories or classes of chemicals/substances.

4.12.2 While recently manufactured cylinders reflect the color coding guidance established by the CGA, older cylinders may not reflect this nomenclature. It is also possible for cylinders to have been repainted a different color from their original.

4.12.3 Cylinder contents should never be determined by the color of the cylinder alone.

4.12.4 The following table provides general guidance on the standard color coding scheme and potential contents associated with those colors.

Standard Color (Color of Cylinder)	Class of Material
Yellow	*Flammable Materials*. All materials known ordinarily as flammables or combustibles.
Brown	*Toxic and Poisonous Materials*. All materials extremely hazardous to life or health under normal conditions, such as toxics or poisons.
Blue	*Anesthetics and Harmful Materials*. All materials productive of anesthetic vapors and all liquid chemicals and compounds hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors.
Green	*Oxidizing Materials*. All materials, which readily furnish oxygen for combustion and fire producers that react explosively or with the evolution of heat in contact with many other materials.
Gray	*Physically Dangerous Materials*. All materials, not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state of pressure or temperature.
Red	*Fire Protection Materials*. All materials provided in piping systems or in compressed gas cylinders exclusively for use in fire protection.

Note: Old cylinders that predate the CGA standard color scheme may not adhere to the color schemes shown above; therefore, additional characteristics such as color bands or identifying decals should also be evaluated. Also, the CGA *Handbook of Compressed Gases*, (most current edition) should be consulted for further information.

4.13 Air Monitoring Requirements

4.13.1 Air monitoring requirements are dependent upon the specific substances contained within the cylinders and will be specified within the individual HASP prepared prior to commencement of field activities. Air monitoring parameters may include, but are not limited to:

- Explosivity (i.e., lower explosive limit [LEL])
- Chemical-specific substance (e.g., chlorine, ammonia, arsine, etc.)

4.13.2 Action levels will be identified in the site-specific HASP.

4.14 Cylinder Staging

4.14.1 Staging involves the organization, and sometimes consolidation, of cylinders that have similar contents or characteristics.

4.14.2 The staging of cylinders will occur in a remote location at the site in order to minimize the potential injury or property damage from an accidental release or emergency decompression (if the integrity of the cylinder is in question, it should not be moved).

4.14.3 Safe distances will be based on the evacuation distances provided in DOT's Emergency Response Guidebook (most current edition).

4.14.4 When multiple cylinders containing different substances are present, the distance should be based on the greatest evacuation distance required by the substances present.

4.15 Cylinder Disposition Operations

4.15.1 Disposition refers to the recycling, treatment, or disposal of a compressed gas cylinder and/or its contents.

4.15.2 Recovery and recycling of materials are preferred over any other method of disposition. Cylinder disposition activities shall be approved by the Regional SH&E Manager.

4.15.3 An effort should be made to recover and recycle the contents of a cylinder; however, if recovering or recycling the contents is not possible, then other options include:

- Venting to the Atmosphere
- Flaring
- Neutralization
- Detonation

4.15.4 Under no circumstances will poisonous, toxic, or ozone-depleting substances be vented to the atmosphere. Only cylinders containing flammable gases should be detonated, as the flammable contents will be consumed in the subsequent explosion.

4.15.5 If the cylinder valve has been determined to be inoperable, then the available options for disposition are limited to having an outside vendor perform the remote opening and sampling of the cylinder, or detonation of the cylinder where the cylinder contents are consumed in the subsequent explosion (flammable gases only).

4.16 Venting to the Atmosphere

4.16.1 Cylinders that contain non-flammable, non-toxic materials can be vented to the atmosphere. All venting activities will be performed in accordance with the following procedures:

- Atmospheric venting will be accomplished at a remote location and in compliance with all applicable environmental air regulatory requirements.
- Atmospheric venting activities will be completed in a Level B Ensemble (unless otherwise specified in the site-specific HASP and cylinder plan).
- Venting activities will be dependent upon a wind direction that does not carry the outgas plume in the direction of an adjacent public structure.
- The cylinder will be properly grounded to confirm a static charge is not generated, potentially resulting in ignition of a flammable gas.
- All tools used on the cylinder will be non-sparking.
- Low-pressure discharging will not exceed 15 pounds per square inch gauge (psig).

- Once discharging has started, all workers will retreat to the exclusion zone (minimum 100 feet) around the remote location until the discharging process is complete.

4.17 Flaring

4.17.1 Flaring activities involve the combustion of the cylinder contents through the discharge of a low-intensity flame. Flaring activities will be performed in accordance with the following procedures:

- Flaring will be accomplished at a remote location and in compliance with all applicable environmental air regulatory requirements.
- Flaring activities will be completed in a Level B Ensemble (in addition, the flaring team members will don Nomex fire-retardant forearm-length gloves and other fire-retardant clothing as specified in the site-specific cylinder plan).
- Flaring activities will be dependent upon a wind direction that does not carry the combustion plume in the direction of any offsite structure or activity, or into uncontrolled (public access) areas.
- The cylinder will be properly grounded to confirm a static charge is not generated, potentially resulting in ignition of a flammable gas.
- All tools used on the cylinder will be non-sparking.
- Low-pressure discharging will not exceed 15 pounds per square inch gauge (psig).
- A hot work permit shall be completed prior to the start of flaring activities (See *S3NA-418-PR Welding, Cutting, and Other Hot Work*).
- No other cylinders will be within 35 feet of the cylinder being flared.
- Flaring activities will use a low-pressure discharge and maintain a small, low-intensity flame.
- A firewatch will be established, with a worker stationed outside the exclusion zone with a fire extinguisher (20A:100B:C) during flaring activities (i.e., fire watch). During the work the worker assigned to the firewatch will have no other duties.
- The flare will be positioned so that it is not pointing toward any flammable materials, personnel, or equipment in the immediate area.

4.18 Neutralization

4.18.1 Neutralization refers to the on-site neutralization of the cylinder contents through a controlled chemical reaction process. Specialized equipment may be necessary based on the chemical involved, as well as reaction by-products, catalysts, or physical conditions (i.e., temperature, acidic, basic, etc.). Neutralization activities will be performed in accordance with the following procedures:

- Neutralization is the required disposition method for cylinders containing acid gases, as well as many alkaline gases.
- The neutralization process shall be approved by a professional engineer (e.g., chemical) or based on a published chemical-specific neutralization methodology.
- Liquid levels in the reaction vessels will be maintained at least 12 inches below the top of the vessel.
- Based on the specific chemical reaction, the temperature of the reaction vessel and its contents will be monitored continuously and controlled accordingly.
- Pressure levels will be maintained within acceptable limits to prevent the reaction from accelerating, unwanted by-product formation, or the break-through of the chemical intended to be neutralized.
- Personnel will wear the PPE identified within the site-specific HASP and cylinder plan.

4.19 Detonation

4.19.1 Detonation refers to the use of explosives to open and subsequently consume the contents of the cylinder by the heat generated during the explosion. Detonation activities will be performed in accordance with the following procedures:

4.19.2 A detonation plan shall be submitted to and approved by the Regional SH&E Manager prior to the commencement of cylinder detonation activities.

4.19.3 The detonation of compressed gas cylinders will be completed under the guidance of experienced ordnance and explosives (OE) professional who is licensed in the use of explosives (see *S3NA-514-PR OE and UXO Operations*).

4.19.4 A sufficient amount of explosives will be used to consume the entire contents of the cylinder (flammable gases only).

4.19.5 A blast pit will be excavated where all detonations will take place.

4.19.6 The OE professional will determine the blast hazard zone/potential debris impact zone, and this area will be evacuated prior to the detonation.

4.19.7 The OE professional will sound a warning signal (e.g., horn or equivalent) three times to indicate that a detonation is imminent and confirm all personnel have evacuated the blast hazard zone prior to detonation.

4.19.8 Personnel will be on standby outside the blast hazard zone with fire extinguishers (minimum rating of 20A:100B:C).

4.20 Cylinder Decommissioning Operations

4.20.1 Decommissioning refers to the removal of a compressed gas cylinder from service by rendering it permanently unusable.

4.20.2 Prior to decommissioning, cylinder contents will be verified, removed from the cylinder, and the cylinder purged with an inert gas (e.g., nitrogen, carbon dioxide, etc.).

4.20.3 All identifying marks or decals will be removed from the cylinder.

4.20.4 The Regional SH&E Manager shall be contacted prior to the decommissioning of compressed gas cylinders that contain or previously contained:

- Ethylene oxide
- Arsine
- Diborane
- Hydrogen selenide
- Cyanogen chloride
- Amines
- Hydrogen sulfide
- Acetylene
- Methyl mercaptan

4.20.5 Additional safety precautions may be necessary due to highly reactive residues left behind by these substances.

4.20.6 The recommended methods of decommissioning include:

- Burning/torch-cutting an elongated hole into the side of the cylinder (S3NA-418-PR Welding, Cutting and Other Hot Work)
- Torch-cutting the cylinder in half (See S3NA-418-PR Welding, Cutting and Other Hot Work)
- Crushing the cylinder

4.21 General Use of Compressed Air or Gas

4.21.1 Compressed air or other compressed gases are not to be used to blow dirt, chips, or dust from clothing while it is being worn. Compressed air used for other types of cleaning (other than clothing/personnel) is to be limited to 30 psig.

4.21.2 The use of blown compressed air is to be controlled, and proper personal protective equipment or safeguards utilized, to protect against the possibility of eye injury to the operator or other persons.

4.21.3 Compressed air or gases are not to be used to empty containers of liquids.

4.21.4 Compressed gases are not to be used to elevate or otherwise transfer any hazardous substance from one container to another unless the containers are designed to withstand the operating gas pressure with a safety factor of at least four.

4.22 **Personal Protective Equipment (*S3NA-208-PR-Personal Protective Equipment Program*)**

4.22.1 The inspection of cylinders containing unknown substances will be performed in a Level A (PPE) ensemble as a minimum, while cylinders containing known substances, and in good condition, will be inspected in an appropriate ensemble designated within the site-specific Health and Safety Plan (HASP).

4.22.2 Where the use of a Level A or B ensemble is anticipated, the SH&E Department shall be contacted during the pre-task planning to determine the appropriate Level ensemble components, and personnel involved in the activity. The use of a Level A PPE ensembles are required to be approved by the Regional SH&E Manager.

4.22.3 PPE includes, but is not limited to:

4.22.3.1 Eye and face protection

4.22.3.2 Steel toed work boots

4.22.3.3 Hearing protection

4.22.3.4 Gloves

4.22.3.5 Respiratory equipment, as required

4.23 **Training**

4.23.1 On-site orientation to the use and hazards of the equipment shall be completed for all staff handling or coming into contact with compressed air tools and equipment or compressed gas cylinders.

5.0 Records

5.1 None

6.0 References

6.1 29 CFR 1910.101 Handling of Compressed Gas Cylinders

6.2 Compressed Gas Association Pamphlet P-1-1965

6.3 S3NA-506-FM Cylinder Inspection

6.4 S3NA-418-PR Welding, Cutting, and Other Hot Work

6.5 DOT's Emergency Response Guidebook

6.6 S3NA-208-PR-Personal Protective Equipment Program

S3NA-506-FM Cylinder Inspection

Basic Cylinder Information	
Serial Number:	Cylinder Size:
Pressure Rating:	Current Pressure:
Vendor/Owner:	Contents:
Date of Receipt:	Date of Inspection:
Inspected by (*Name*):	

Condition	Yes	No
DOT container specification number present on cylinder?		
Proper DOT shipping name, ID # and hazard class on cylinder?		
Manufacturer's name and appropriate hazard warnings present?		
Serial number of cylinder and inspectors official mark present?		
Most recent hydrostatic test date marked and within 5 years?		
Cylinder valve and neck ring free of oil, grease or other foreign matter?		
Valve threads clean and in good condition?		
Pressure rating of cylinder not exceeded?		
Cylinder surface is free of cracks, and dents, gouges, weld defects, etc.?		
Cylinder surface is free of arc burns and fire burns?		
Cylinder cap is present and threaded in place?		
Cylinder surface, particularly bottom, is free of excessive corrosion, and pitting?		

This checklist will be used by employees who accept the delivery of compressed gas cylinders at an office, laboratory, or project location to document the condition of the cylinder upon receipt. In offices where cylinders are stored, used or shipped to project locations on a regular basis, the qualified person designated to oversee cylinder operations will use this checklist to perform routine cylinder inspections and create a historical file on the condition of each cylinder.

S3NA-506-ST Compressed Gases

Jurisdiction	Regulation
United States	
OSHA	49 CFR (Transportation), Parts 100-185 Hazardous Materials Regulations
	29 CFR 1910 (General Industry) Subpart H Hazardous Materials
	29 CFR 1926 (Construction) Subpart J .350 Gas Welding and Cutting
DOT	Emergency Response Guidebook (latest edition)
Compressed Gas Association, Inc. (CGA)	CGA Guidelines and CGA Handbook of Compressed Gases (latest editions)
Canada	
Alberta	OHS Code (2009) Sect 171
British Columbia	OHS Regulation (1997) Sect 4.41
Manitoba	Workplace Health and Safety Regulation (217/2006) Sect 27.1 – 27.3
New Brunswick	OHS Regulation (91-191) Sect 74 – 79
Newfoundland/Labrador	OHS Regulation (C.N.L.R. 1165/96) Sect 75
Nova Scotia	OHS Regulation (N.S. Reg. 44/99) Sect 45 – 49
NWT/NU Territories	General Safety Regulations (R.R.N.W.T. 1990, c. S-1), Safety Act (SI-013-92) Sect 155 – 162
Ontario	O. Reg. 213/91 Sect 6, 42 O. Reg. 851 Sect 49
Prince Edward Island	OHS Regulations (EC180/87) Sect 37.18 – 37.23
Quebec	OHS Regulation (R.R.Q., c. S-2.1, r.19.01 O.C. 885-2001) Sect 77, 78, 325 – 328 Safety Code for the Construction Industry (R.R.Q. 1981, c. S-2.1, r. 6) Sect 3.13.4 – 3.13.10
Saskatchewan	OHS Regulation (R.R.S., c. O-1, r. 1) Sect 371, 372
Yukon Territory	OHS Regulations (O.I.C. 2006/178) Sect 4.05, 4.06, 8.20, 8.21

The following standards apply to compressed gas tools and equipment:

Association	Standard
Canadian Standards Association (CSA)	CAN/CSA Standard-Z275.3-M86 (R2004), Occupational Safety Code for Construction Work in Compressed Air
OSHA	29 CFR 1926 (Construction) Subpart I .300-307 Tools-Hand and Power

S3NA-506-WI Compressor Safety Card

1.0 Objective / Overview

1.1 Compressors should be used with extreme caution in order to prevent personal injury.

1.2 When using a compressor it's important to follow the manufacturer's instructions to avoid injuring someone or damaging your compressor.

1.3 Allow only trained, authorized personnel to operate the compressor. Along with training, other safety measures include: proper maintenance of equipment and personal protective equipment.

2.0 Safe Operating Guidelines

2.1 Follow manufactures recommended operating instructions, every compressor is not the same. Maintain adequate ventilation.

2.2 Gas and Diesel powered generators emit carbon monoxide (CO). Never operate a fuel-powered compressor in an enclosed building without proper ventilation.

2.3 Turn the compressor off to refuel. Gasoline and its vapors may ignite if they come into contact with hot components or an electrical spark, store fuel in a properly designed container in a secure location.

2.4 Operators shall perform a pre-operational check of all air hoses, couplings, and connections to determine if leakage or other damage exists. Tag unsafe equipment and take out of service immediately.

2.5 Decompress air from the compressor prior to removing any caps or air equipment attachments such as jackhammers, drills, etc.

2.6 Keep oil and flammable material clear of air fittings and joints.

2.7 Make sure connections are secure to avoid a hose coming loose during use.

2.8 To avoid a shock, make sure that your hands are dry and you're standing in a dry place whenever you operate an electrically powered compressor.

2.9 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.

2.10 Have a Class A:B:C fire extinguisher readily available at all times.

3.0 Potential Hazards

3.1 Burns from contact with the hot muffler or engine

3.2 Shocks/electrocution

3.3 Noise exposure

3.4 Inhaling exhaust gases, CO

3.5 Contact with pressurized air

4.0 Training Requirements

4.1 Review of Applicable SOPs.

4.2 Demonstrated knowledge on the use of the compressor.

4.3 Review of manufacturers operating guidelines.

5.0 Personal Protective Equipment (Level D PPE)

5.1 Leather Gloves

5.2 Hearing Protection

5.3 Long Sleeve Shirt (e.g., to shield from burns, etc.)

AECOM General Electrical Safety **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	601
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

To minimize and control electrical hazards in the workplace.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations

3.0 DEFINITIONS

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/cm^2).

Flash Hazard – A dangerous situation associated with the release of energy caused by an electric arc.

Energized Electrical Equipment – Electrically connected to or having a source of voltage.

Shock Hazard – A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

Portable Electric Equipment – Cord and plug connected equipment and extension cords.

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.

Qualified Persons – Individuals that have specific and documented training to avoid the hazards of working on or near energized electrical equipment and have been specifically permitted to work on or near exposed energized and parts.

Unqualified Persons – Individuals with little or no training to avoid the hazards of energized electrical parts or equipment.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROJECT MANAGER (FIELD TASK MANAGER, SUPERVISOR)

- The AECOM Project Manager, Field Task Manager or Supervisor is responsible to determine if AECOM employees are exposed to electrical hazards.
- The Manager or Supervisor must determine the appropriate safe guards to be put in place to protect employees.

4.2 REGIONAL SH&E MANAGER

- Provides technical guidance in support of this procedure

4.3 SITE SAFETY COORDINATOR

- The Site Safety Coordinator (SSC) shall assist the site manager/supervisor in compliance with the requirements of this procedure.

4.4 EMPLOYEES

- All AECOM employees engaged in project field activities shall follow these procedures.

5.0 PROCEDURE

5.1 TRAINING

Employees who have potential exposures to electrical hazards shall be trained in and familiar with the electrical safety-related work practices required by 29 CFR 1910.331 through 1910.335.

5.2 GENERAL REQUIREMENTS FOR ON-SITE USE OF ELECTRICITY

- AECOM personnel that meet the requirements of a Qualified Person, and have been specifically designated as such in the project health and safety plan, may set up temporary circuits up to 220 volts. Maintenance or installation of circuits over 220 volts will require professionally trained personnel (i.e. professional electricians).
- Lockout devices will be used to prevent the operation/energizing of equipment or circuits during maintenance or other work. Tagout devices will be used only where it is not feasible to use a lockout device.
- Insulated tools and electrical handling equipment shall be inspected prior to use to ensure the protective properties are not damaged. Damaged equipment will be tagged and removed from service.
- Extension cords and electrical connections on hand-held 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 “DAMAGED” and removed from service. Manufacturer-installed insulated electrical cords will not be repaired or spliced.
- Extension cords are to be kept clean, free of kinks, and protected from oil, hot or sharp surfaces, and chemicals. 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 cords will be appropriate for the specific task and environment.
- Attachment 1 outlines additional requirements for working on live electrical systems located on AECOM job sites.
- Ground Fault Circuit Interrupter (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 and Attachment 2 (i.e. circuits that are not part of a permanently installed facility electrical system—such as on a construction site or temporary field installation).

5.3 DISTRIBUTION SYSTEM SETUP

- Under no circumstances shall electrical lines be routed through doorways, hatches, windows or other openings where lines could be crimped, bent or cut.
- Circuit breakers shall be labeled as to use.
- All circuit breaker panels shall be kept covered when not in use.
- A fuse puller shall be used to remove cartridge fuses where one or more energized circuits are present.
- All live parts of electrical equipment operating at 50 volts or more shall be properly guarded against accidental contact, which includes:
    - Limit access to the equipment to qualified employees only.
    - Label using the proper accident prevention sign, stating DANGER as well as the voltage of the equipment.
    - Provide a conductor of the ampacity of not less than the rating of the circuit breaker or fuses protecting that circuit.

- Ensure that a bare conductor or earth return is not used for any temporary circuit.
- Ensure that all electrical wiring is protected from physical damage by covering and by not placing it in a location where it can be crimped or cut, etc.
- Extension cords for portable electric tools shall be of a 3-wire type.

- Use of extension cords is allowed only for temporary installations not to exceed 90 days (e.g., decorations).
- Extension cords shall be provided with a plug cap, which 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.
- Extension cords shall be inspected prior to each use to ensure that there is no damage or defects. Defective cords shall not be used.
- Extension cords used with grounding-type equipment (e.g., three-prong plug) shall contain a grounding-type conductor (have three plugs to accept the ground plug).
- Ground fault circuit interrupters shall be used for all non-permanent wiring needed for construction purposes, or when working in wet or moist areas, or onboard ships.
- Extension cords used in highly conductive work locations (e.g., wet areas) shall be of the type approved for such locations.
- Grounding-type equipment (e.g., three-prong plugs) shall not be modified to mate to incompatible outlets (e.g., cut off grounding prong to fit two prong outlets).
- 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.
- 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.
- Only qualified personnel shall perform electrical wiring or connections.
- If work on electrical systems is required, ensure that specific lock-out/tag-out procedures are implemented.

5.4 WORKING ON OR NEAR ENERGIZED PARTS

Working on or near energized parts covers either potential direct physical contact or contact by means of tools or equipment.

- Only properly trained persons shall work with energized equipment or electric circuits (e.g., licensed electrician).
- Work on energized systems requires special precautionary techniques, PPE, insulating and shielding materials, insulating tools, and testing equipment.
- Personnel working in the vicinity of overhead power lines, either on the ground or elevated, shall not physically be closer than, or allow conductive tools/equipment closer than, the distances specified below:

Voltage Range	Distance
300 volts and less	Avoid Contact
More than 300 volts, but not more than 750 kilovolts (kV)	1 foot
More than 750 volts, but not more than 2 kV	1½ feet
More than 2 kV, but not more than 15 kV	2 feet
More than 15 kV, but not more than 37 kV	3 feet
More than 37 kV, but not more than 87.5 kV	3½ feet
More than 87.5 kV, but not more than 121 kV	4 feet
More than 121 kV, but not more than 140 kV	4½ feet

5.5 GROUNDING

- The path to ground from circuits, equipment, and enclosures must be permanent and continuous.
- Electrical installations at project sites must be protected by either an equipment grounding conductor program or GFCIs. The two options are:
    - All 120-volt, single-phase, 15- and 20-amp receptacles that are not part of permanent wiring must be protected by GFCIs.
    - The equipment grounding conductor program must cover extension cords, receptacles, and cord- and plug-connected equipment. The program must include the following elements:
        - A written description of the program.
        - At least one competent person to implement the program.
        - Daily visual inspections of extension cords, and cord- and plug-connected equipment for defects. Equipment found damaged or defective shall be removed from use, and not used until repaired
        - Continuity tests of the equipment grounding conductors or receptacles, extension cords, and cord- and plug-connected equipment every three months.
        - Compliance with the requirements for grounding of systems, circuits, and equipment (see 1926.404).
- If the equipment grounding conductor program option is chosen, the designated competent person at the site shall maintain inspection records.

5.6 ASSURED GROUNDING

- Where AECOM Operations is responsible, projects will have in place a program for the testing and inspection of all temporary electrical supply systems.
- Assured grounding is applicable to all cord sets, receptacles that are not a part of the permanent wiring of a building or structure, and all equipment and tools connected by cord or plug.
- All cord sets and receptacles must be visually inspected for damage before use.
- All items covered by this procedure shall have their grounding conductor tested for continuity and all cord attachments and receptacles shall be tested for polarity to be sure the ground conductor is connected to the proper terminal.
- Testing will be done on the following intervals:
    - Before first use of any item.

- After repairs and before placing back into service.
- After every incident which might reasonably be suspected of causing damage.
- At intervals not to exceed 3 months.
    - Any tool, cord or service that does not pass the required tests may not be made available to employees. Such equipment shall be tagged out of service and delivered to the supervisor or competent person for repair or replacement.
    - Only a qualified employee (electrician) designated as the competent person may test electrical devices and will:
        - Prior to testing any item, remove any and all of the old color-coding tape or zip strips.
        - Perform the required ground conductor testing and polarity verifications.
        - After passing the necessary tests, the items will be marked by putting a wrap of the color coding tape or zip strip (of the appropriate color) around the cord close to the male and female ends of the electrical cord or by the male end on tools. Receptacle outlets will be marked in the most practical manner.

5.7 PERSONAL PROTECTIVE EQUIPMENT/WORK PRACTICES

- Non-conductive hardhats shall be worn when there is danger of head injury from electric shock or burns due to exposure to energized parts.
- Jewelry shall not be worn when working around or with energized parts.
- Insulated tools shall be used to work with energized parts. Tools that have insulation that might be damaged (e.g., rubber handles) shall be inspected prior to each use to ensure the insulation is not damaged.
- Eye protection with side shields shall be worn when working with energized parts.
- Rubber mats, non-conductive shields, or protective barriers shall be used as needed to protect employees from electrical hazards.
- Appropriate insulating gloves shall be worn to pick up or unplug connections that are in highly conductive areas, such as in water.
- Do not plug in or unplug electric equipment with wet hands.

5.8 PORTABLE ELECTRICAL EQUIPMENT

- Double-insulated, portable, industrial-type electrical tools meeting the requirements of the National Electrical Code (NEC) are authorized for use (ground wire not required). Where this type of tool is used, the equipment must be distinctly marked.
- Portable electrical tools not provided with special insulating or grounding protection are not for use in damp, wet, or conductive locations (e.g., by persons standing on the ground or on metal floors).
- All portable electrical appliances and equipment where the non-current-carrying metal parts are exposed to contact by personnel shall be grounded by a continuous conductor of adequate capacity from the device to a grounded receptacle. The Site Safety Officer shall resolve any question of whether or not a particular appliance should be grounded.
- Manufacturer-installed guards shall not be tampered with, modified, or removed. These guards will be in place and utilized during operation of equipment.
- The dimension of the working space in the direction of access to energized parts in switchboards, control panels, fused switches, circuit breakers, panel boards, motor controllers, and similar equipment that requires examination, adjustment, servicing, or maintenance while energized, shall not be less than 36 inches deep and 30 inches wide or the width of the equipment, whichever is greater.

- Portable electrical equipment shall be handled in a manner which will not cause physical damage to the equipment.
- Portable electrical equipment shall not be carried by the cord.
- Cords shall not be used to raise or lower equipment.
- Extension cords shall not be fastened with staples, nails, wire, or otherwise hung in such a fashion that could damage the outer jacket or insulation.
- Electrical cords shall not be removed from a receptacle by pulling on the cord line.
- Employees' hands shall not be wet when plugging and unplugging cord and plug connected equipment and extension cords.
- Disconnect portable electric equipment when not in use, before servicing and when changing accessories such as blades, bits and cutters.
- 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.).
- Portable electric equipment and extension cords used in areas exposed to gases, fumes, vapors, liquids or other agents having a deteriorating effect shall be approved for use in those locations.
- Portable electric equipment and extension cords used in areas in which hazardous concentrations of flammable gases or vapors exist shall be approved for use in those locations.
- If an adapter is used to accommodate a three-wire cord to a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong shall never be removed from the plug.
- After a circuit is de-energized by a circuit protective device, the circuit may not be manually reenergized until it has been determined that the equipment and circuit can be safely energized.
- The outlet box for portable extension cords for outdoor use shall be weatherproof and maintained in good condition.

6.0 REFERENCE MATERIAL

SH&E SOP 712 – *Hazardous Energy Control*

SH&E SOP 726 – *Identifying Underground Utilities*

SH&E SOP 727 – *Overhead Electrical Lines*

7.0 ATTACHMENTS

Attachment 1 – Electrical Work Safety Project Guideline

Attachment 2 – Ground Fault Circuit Protection on Construction Sites Work Practice Guideline

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

ATTACHMENT 1
Electrical Work Safety Guideline

ELECTRICAL WORK SAFETY GUIDELINES

1.0 PURPOSE

The purpose of this guideline is to ensure that all live electrical work conducted under the control of AECOM personnel is carried out in accordance with recognized best practices in order to provide adequate protection to workers from the hazards of potential arc flash and/or electrical shock.

2.0 ASSOCIATED AECOM POLICIES

In addition to this guideline, AECOM will also follow all Federal and State/Provincial Regulations, in particular NFPA-70E and 29CFR part 1910 as well as relevant AECOM SH&E Policies, SH&E SOP 712 – *Control of Hazardous Energy* (*Lockout/Tag-out [LOTO])* and SH&E SOP 601 – *Electrical Safety Program*.

3.0 RESPONSIBILITIES

3.1 AECOM's Project Manager:

i. Be familiar with all precautions and Federal and State/Provincial regulations and Best Practices including NFPA-70E.

ii. Provide training on this Best Management Practice to authorized employees covering:
   a. Nature and control of known shock and arc flash hazards.
   b. Means of eliminating and controlling shock and arc flash hazards.
   c. Special electrical PPE requirements (task specific).
   d. Procedure for reporting any deviations to this Best Practice.

iii. Control access to energized electrical equipment with potential of shock or arc flash to authorized personnel only.

iv. Ensuring availability of proper tools for operation and maintenance of electrical equipment.

v. Proper identification and guarding of potentially hazardous electrical equipment.

vi. Providing available electrical one-line diagrams.

vii. Ensure proper housekeeping around energized electrical equipment at all times.

viii. Provide proper working conditions including adequate lighting to facilitate work in a safe environment.

ix. Proper supervision of employees.

x. Maintaining a list of authorized electrical supervisor, authorized electrical worker, and attendant.

xi. Implementation and on-going evaluation of this Best Management Practice.

3.2 Authorized Electrical Supervisor

i. Practice all precautions and Federal and State/Provincial regulations and Best Practices including NFPA-70E.
ii. Understand the hazards that may be faced by the worker during live electrical work including information on the arc flash, shock, and other hazards of live electrical work.
iii. Verify following before signing the live work permit and authorizing live work to begin:
    a) Live work permit and Safe Work Plan have been properly filled and signed by authorized worker and attendant, where applicable.
    b) All precautions specified on live work permit have been taken.
    c) All procedures and equipment specified by the permit are in place.
    d) Safe work plan has been developed, reviewed and signed by all involved.
iv. Terminate the work and cancel the permit when live work has been completed or any new electrical hazard arises.
v. Verify communication modes are available and have been tested.
vi. Remove unauthorized individuals who enter or who attempt to enter the approach boundaries during live work.
vii. Ensure that live work remains consistent with terms of the live work permit and that acceptable working conditions are maintained.
viii. Withdraw the live work permit and stop all work if unsafe conditions are reported during any live work (e.g. sparking, smoldering etc.). Further work on that equipment shall not be permitted until cause of unsafe condition is thoroughly investigated and live work procedure has been reviewed to prevent reoccurrence.

3.3 Authorized Electrical Attendant

i. Practice all precautions and Federal and State/Provincial regulations and Best Practices including NFPA-70E.
ii. Understand the hazards that may be faced during live work, including potential for arc flash, shock hazard and other related hazards.
iii. Be aware of the potential of arc flash or shock possible to the authorized worker.
iv. Maintain an accurate count of authorized workers working near the live equipment or inside approach boundaries.
v. Remain near the approach boundary until relieved by another authorized electrical attendant.
vi. Communicate with authorized worker as necessary to ensure maintenance of safe conditions at all times.
vii. 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. Orders the Authorized worker to stop live work under any of the following conditions:
    b. The attendant detects a problem;
    c. The attendant detects the signs of short-circuiting, any evidence of electrical sparking, smoldering or any other abnormality;
    d. The attendant detects a situation outside the approach zone that could endanger the worker, and

e. If the attendant cannot effectively and safely perform all assigned duties.

viii. Perform no other duties that might interfere with the attendant's primary duty to monitor and protect the authorized worker.

3.4 Authorized Electrical Worker

i. Practice all precautions and Federal and State/Provincial regulations and Best Practices including NFPA-70E.
ii. Be continuously alert, focused and aware of the hazards of performing the task.
iii. Understand AECOM Safety, Health and Environmental policies and standards as well as site-specific electrical safe work practices.
iv. Examine and understand all the documents provided by AECOM and manufacturer, including all specific hazards, advisories, cautions, etc.
v. Perform all work in accordance with applicable Federal and State/Provincial regulations, AECOM Policies, safe work practices, and this Best Management Practice.
vi. Be knowledgeable of the use and selection of the proper tools to safely perform the electrical task safely.
vii. Completing Safe Work Plan prior to start of task and during work, if conditions change.
viii. Maintain good housekeeping around work areas. Remove all debris, materials, etc. at the completion of tasks.
ix. Report any hazardous (uncontrolled) conditions to AECOM's authorized supervisor.
x. Understand the hazards that may be faced during live work, including arc flash, shock, or other electrical hazards.
xi. Properly use required PPE and electrical tools as specified in this best practice.
xii. Communicate with the attendant as necessary.
xiii. Alert the attendant whenever any abnormality occurs (e.g. sparking, minor shock, burning smell, etc.) or symptoms of unsafe conditions are observed.
xiv. Stop all work and exit from the approach zone whenever:
    a) An order to evacuate is given by the authorized attendant or the authorized supervisor; or
    b) When the worker observes any waning sign or symptom of short circuiting or a dangerous situation; or
    c) When the supervisor orders to stop work.

4.0 MULTI-EMPLOYER LIVE ELECTRCIAL WORK COORDINATION

4.1 AECOM's Requirements – When using another employer to perform work involving live electrical work, AECOM must:

i. 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 NFPA-70E.
ii. Appraise the contractor of the elements, including the hazards identified and all past experiences with the live work that make the live work hazardous.

iii. 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.
iv. 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.
v. 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 must:

i. Obtain any available information regarding live work from the project manager.
ii. Coordinate live work operations with the project manager when both AECOM personnel and contractor personnel will be jointly working in or near approach zone.
iii. Practice all precautions and Federal and State/Provincial regulations and Best Practices including NFPA-70E.
iv. Inform AECOM's project 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 REVIEW AND UPDATE

This Best Management Practice will be reviewed and updated annually.

6.0 DEFINITIONS

6.1 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/cm^2).

6.2 Flash Hazard: A dangerous situation associated with the release of energy caused by an electric arc.

6.3 Energized Electrical Equipment: Electrically connected to or having a source of voltage.

6.4 Shock Hazard: A dangerous situation associated with the possible release of energy caused by contact or approach to live parts.

7.0 REQUIRED MINIMUM QUALIFICATIONS

All electrical work including instrumentation, installations, maintenance, troubleshooting, calibration, and operation of breakers will only be conducted by qualified, trained, and skilled personnel (i.e., includes both AECOM personnel and contractors/subcontractors). These qualifications must meet all requirements mandated by the Federal/State Regulations as well as applicable electrical associations and trade bodies.

Project Manager, in consultation with SH&E Department, would determine the minimum qualifications requirements for any work with potential of arc flash.

8.0 WORKING ON OR NEAR ELECTRICAL CONDUCTORS OF CIRCUIT PARTS

8.1 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.

i. **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.

ii. **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*.**

8.2 **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.

8.3 **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:

i. Shock Hazard Analysis – A shock hazard analysis shall determine the voltage to which personnel will be exposed, boundary requirements, and the personal protective equipment necessary in order to minimize the possibility of electrical shock.

ii. **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 personal protective equipment that people within the flash protection boundary shall use.

9.0 SHOCK HAZARD ANALYSIS AND APPROACH BOUNDARIES

The National Fire Protection Association (NFPA) has determined that a comprehensive Shock Hazard Analysis Survey is the best method to:

1. Systematically analyze shock hazards,
2. Identify approach boundaries, and
3. Identify appropriate personal protective equipment (PPE).

Before permitting live work on electrical equipment, each project site having electrical equipment operating at more than 50 volts is required to conduct Shock Hazard Analysis Survey. Upon completion of survey, the applicable electrical areas/spaces will be labeled in accordance with survey results.

Shock hazard analysis for individual equipment is not required if a facility-wide shock hazard analysis has been conducted and conditions (including labels and signage) are maintained at all times.

NOTE: Only authorized personnel are allowed to work within the approach boundaries.

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 Appendix A-1 [Table 130.2 (C) of NFPA 70-E].

In the absence of facility-wide survey, a shock hazard analysis (including the identification of approach boundaries) shall be conducted in accordance with NFPA 70E Section 130.2 and Table 130.2 (C) (see Appendix A-1 of this Practice) for all electrical equipment operating at over 50 Volts.

Results of both facility-wide as well as individual shock hazard survey shall be made available to all authorized employees. Additionally, any recommendations given by the survey generated from the survey shall be reviewed by the project manager and shall be addressed in a timely manner.

10.0 ARC FLASH HAZARD ANALYSIS AND APPROACH BOUNDARIES

Arc flash safety requirements apply to all electrical equipment operating at 50 volts or more.

Similar to the shock hazard analysis, the NFPA has determined that a comprehensive Arc Flash Hazard Analysis Survey is the best method to:

i. Systematically analyze the potential for arc flash;
ii. Identify limits of approach; and
iii. Identify appropriate personal protective equipment (PPE).

Once a comprehensive facility arc flash 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 qualified personnel ensure 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.

Please refer to Appendix A-1 for details.

Prior to performing any work on energized electrical systems, an arc flash hazard analysis [including the identification of approach boundaries) will be conducted in accordance Appendix F of this practice (taken from NFPA 70E Section 130.3)].

11.0 REQUIRED PPE CATEGORIZED BY EXPOSURE

The following specialized PPE requirements will be used while working on energized electrical systems:

- PPE as prescribed by the shock hazard analysis and arc flash analysis; or
- PPE requirements identified in Appendix A-2 of this practice (taken from NFPA 70E Section 130.2 and 130.7).

12.0 REQUIRED TOOLS AND EQUIPMENT

Only tools and testing or protective equipment approved by ANSI/ASTM for the relevant voltage rating [see Table130.7(C)(8) or Canadian Standards Association for appropriate voltage rating] will be used when working on energized electrical systems. All tools and testing or protective equipment must be visually inspected prior to use to ensure the protection systems associated with the tool or equipment is not damaged or impaired, and that diagnostic meters and tools are configured properly. Any tool or testing or protective equipment suspected of being compromised will be immediately taken out of service and will be tagged for disposal.

13.0 WORK ON ENERGIZED ELECTRICAL SYSTEMS

It is the policy of AECOM that all electrical maintenance or troubleshooting will be done on de-energized circuits, to the extent practically possible. Work on energized circuits can only be done under special circumstances using the "Live Work Permit" issued by authorized electrical supervisor. This permit takes into consideration the voltage levels, known electrical hazards, communication requirements, and need for watch persons, etc. Following procedure will be observed for live work permit:

i. The person requesting the work (authorized worker) will complete the permit and will retain the original with him during the work. Copy of the permit will be displayed at prominent location in the control room as a notice that live work has been authorized in certain part of the plant/project.
ii. Permit will be reviewed for correctness, proper safety precautions, and adequacy of controls by the authorized electrical supervisor. After satisfying all safety requirements, authorized electrical supervisor will sign the permit and will give the original copy to the authorized electrical worker.
iii. Upon work completion, the authorized worker will note any observation on the permit and will return the original to the authorized supervisor.
iv. Authorized supervisor will keep both copies of the permit as controlled record for a period of 12 months.

Following conditions will be met for live electrical work:

i. If any equipment or instrumentation is to be disabled while other related components or systems are still functioning, then the Live Work Permit should record how process safety of the remaining systems will be maintained.
ii. All electrical and instrumentation work conducted will be recorded in the applicable MCC log. The documentation will include reference to permit number where appropriate.
iii. The worker must inform the operations supervisor that he intends to de-energize a circuit. He will also inform the operations supervisor when the work is complete and that the system can be returned to service.

See Appendix D for a suggested template of "Live Work Permit".

14.0 LOCKOUT/TAGOUT POLICY AND PROCEDURES

All equipment will be locked out prior to any work commencing in accordance with AECOM's policy SH&E SOP 712 – Control of Hazardous Energy (LOTO) and applicable site specific lockout/tagout program.

15.0 TROUBLESHOOTING PROCEDURE

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, sometimes troubleshooting may require limited work on live circuits that will be done using the "Live Work Permit" and using site-specific Troubleshooting Guidelines.

16.0 HOUSEKEEPING

All areas containing electrical equipment must:

- Be maintained and kept clean
- Be well illuminated
- Not be used for storage of supplies
- Not be used for the storage of any flammable materials
- Be assessed for safety hazards
- Be suitably ventilated to control dust, temperature and humidity.

17.0 COMMUNICATION

Personnel working in or around equipment with electrical hazards must employ suitable means of communication to ensure their safety.

The means of communication may include:

- Authorized attendant (required for ALL live work conducted on 600 volts and above) **CFR 29 1910.335(b)(3)**
- Permits
- Two Way Radios

18.0 SIGNAGE AND LABELS

MCCs, ECRs, 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:

1. Flash Hazard Boundary (Arc Flash Current)
2. Flash Hazard at 18 inches in cal/cm^2 or joules
3. Hazard Risk Categories (PPE Requirements)
4. Shock Hazards
5. Limited Approach Boundaries
6. Restricted Approach
7. Prohibited Approach
8. Log book to record all electrically related activities

All doorways to buildings and enclosures containing energized electrical equipment will be signed to indicate:

- Access is restricted to authorized personnel only
- Electrical hazards exist beyond this (boundary, door, etc.)

19.0 MANAGEMENT OF CHANGE

Any changes to electrical and/or project instrumentation will be conducted following the prescribed management of change policy.

APPENDIX A-1

TABLE 130.2(C) 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 Moveable Conductor	Exposed Fixed Circuit Parts	Restricted Approach Boundary; includes inadvertent movement adder	Prohibited Approach Boundary
Up to 50 Volts	Not Specified	Not Specified	Not Specified	Not Specified
50-300	10 ft	3.5 ft	Avoid Contact	Avoid Contact
300-750	10 ft	3.5 ft	1 ft	1 inch
More than 750 Volts	Consult NACO's Master Electrician or other authorized electrician.			

APPENDIX A-2

TABLE 130.7(C)(10) PROTECTIVE CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT (PPE) MATRIX

TABLE 130.7(C)(11) PROTECTIVE CLOTHING CHARACTERISTICS

Hazard/Risk Category	Clothing Description (Typical number of clothing layers is given in parentheses)	Required Minimum Arc Rating of PPE [(J/cm2 (cal/cm2)]
0	Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd^2 (1)	N/A
1	FR shirt and FR pants or FR 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)

NOTE:

Arc rating: *Arc rating is defined in Article 100 and can be either ATPV or E_{BT}.*

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.*

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.*

APPENDIX B

Protective Clothing and Equipment	Protective Systems for Hazard/Risk Category					
Hazard/Risk Category Number	**-1 (Note 3)**	**0**	**1**	**2**	**3**	**4**
Non-melting (according to ASTM F 1506-00) or Untreated Natural Fiber						
a. T-shirt (short-sleeve)	X			X	X	X
b. Shirt (long-sleeve)		X				
c. Pants (long)	X	X	X (Note 4)	X (Note 6)	X	X
FR Clothing (Note 1)						
a. Long-sleeve shirt			X	X	X (Note 9)	X
b. Pants			X (Note 4)	X (Note 6)	X (Note 9)	X
c. Coverall			(Note 5)	(Note 7)	X (Note 9)	(Note 5)
d. Jacket, parka, or rainwear			AN	AN	AN	AN
FR Protective Equipment						
a. Flash suit jacket (multilayer)						X
b. Flash suit pants (multilayer)						X
c. Head protection						
1. Hard hat			X	X	X	X
2. FR hard hat liner					AR	AR
d. Eye protection		--	--	--	--	--
1. Safety glasses	X	X	X	AL	AL	AL
2. Safety goggles				AL	AL	AL
e. Face and head area protection		--	--	--	--	--
1. Arc-rated face shield, or flash suit hood				X (Note 8)		
2. Flash suit hood					X	X
3. Hearing protection (ear canal inserts)				X (Note 8)	X	X

Protective Clothing and Equipment	Protective Systems for Hazard/Risk Category					
Hazard/Risk Category Number	**-1 (Note 3)**	**0**	**1**	**2**	**3**	**4**
f. Hand protection			--	--	--	--
Leather gloves (Note 2)			AN	X	X	X
g. Foot protection						
Leather work shoes			AN	X	X	X

AN = As needed

AL = Select one in group

AR = As required

X = Minimum required

NOTES:

1. See Table 2. Arc rating for a garment is expressed in cal/cm^2.
2. If voltage-rated gloves are required, the leather protectors worn external to the rubber gloves satisfy this requirement.
3. Hazard/Risk Category Number "-1" is only defined if determined by Notes 3 or 6 of Table 130.7(C)(9)(a).
4. Regular weight (minimum 12 oz/yd^2 fabric weight), untreated, denim cotton blue jeans are acceptable in lieu of FR pants. The FR pants used for Hazard/Risk Category 1 shall have a minimum arc rating of 4.
5. Alternate is to use FR coveralls (minimum arc rating of 4) instead of FR shirt and FR pants.
6. If the FR pants have a minimum arc rating of 8, long pants of non-melting or untreated natural fiber are not required beneath the FR pants.
7. Alternate is to use FR coveralls (minimum arc rating of 4) over non-melting or untreated natural fiber pants and T-shirt.
8. A face shield with a minimum arc rating of 8, with wrap-around guarding to protect not only the face, but also the forehead, ears, and neck (or, alternately, a flash suit hood), is required.
9. Alternate is to use two sets of FR coveralls (the inner with a minimum arc rating of 4 and outer coverall with a minimum arc rating of 5) over non-melting or untreated natural fiber clothing, instead of FR coveralls over FR shirt and FR pants over non-melting or untreated natural fiber clothing.

Table 2: Protective Clothing Characteristics

Hazard/Risk Category	Clothing Description (Typical number of clothing layers is given in parentheses)	Required Minimum Arc Rating of PPE [(J/cm2 (cal/cm2)]
0	Non-melting, flammable materials (i.e., untreated cotton, wool, rayon, or silk, or blends of these materials) with a fabric weight at least 4.5 oz/yd^2 (1)	N/A
1	FR shirt and FR pants or FR 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)

NOTE:

Arc rating is defined in Article 100 and can be either ATPV or E_{BT}. 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. 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.

APPENDIX C

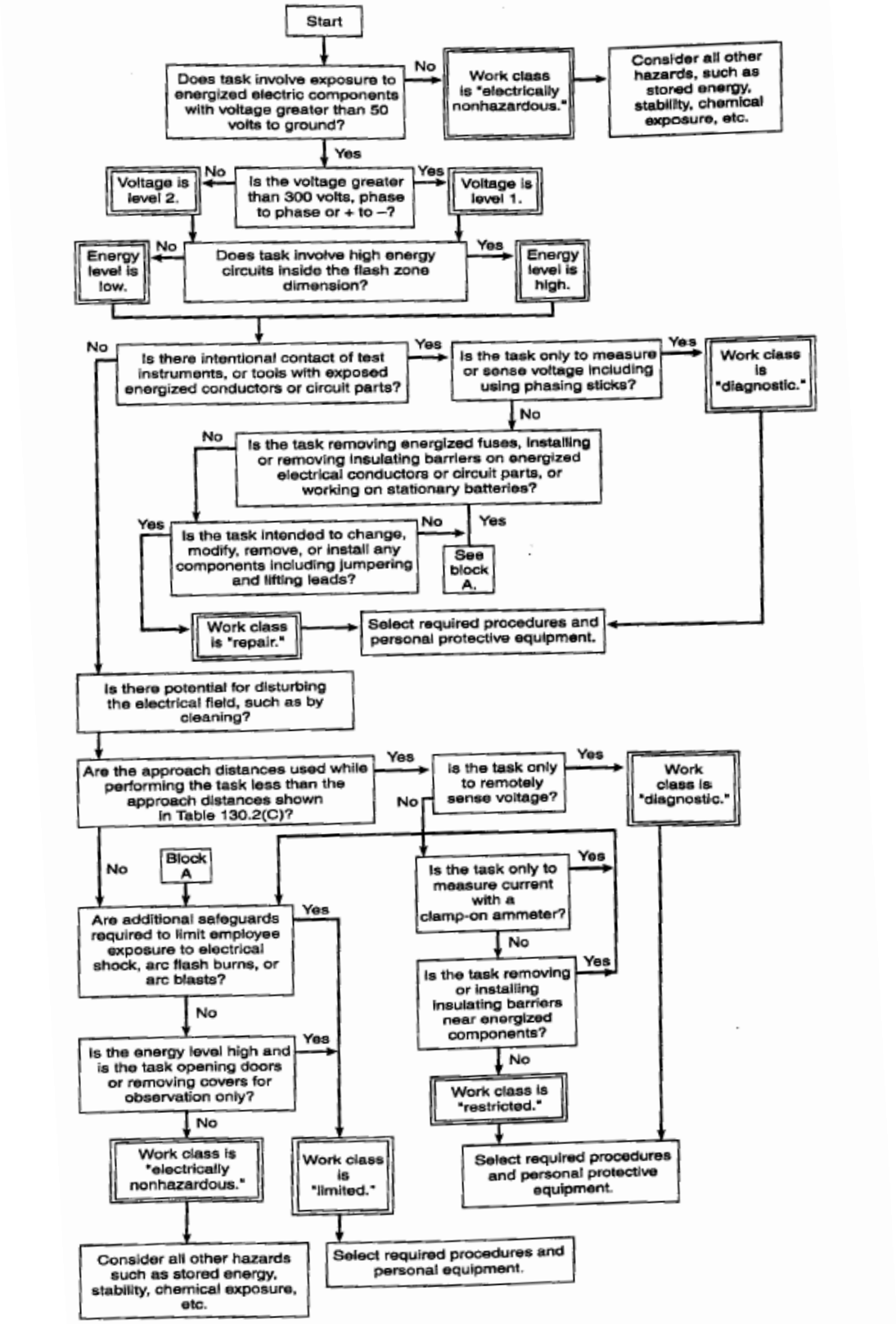


Figure F.1 Hazard/Risk Analysis Evaluation Procedure Flow Chart.

APPENDIX D

LIVE WORK PERMIT

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 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: _____	☐
(2) Description of the Safe Work Practices to be employed: _____	☐
(3) Results of the Shock Hazard Analysis: _____	☐
(4) Determination of Shock Protection Boundaries: _____	☐
(5) Results of Flash Hazard Analysis: _____	☐
(6) Determination of the Flash Protection Boundary: _____	☐
(7) Necessary personal protective equipment to safely perform the job: _____	☐
(8) Means employed to restrict the access of unqualified persons from the work area: _____	☐
(9) Evidence of completion of a Job Briefing including discussion of any job-related hazards: _____	☐

(10) Do you agree the above described work can be done safely? ☐ Yes ☐ No (If *no*, return to requester)

_____

_____	_____	_____	_____
Electrically Qualified Person(s)	Date/Time	Electrically Qualified Person(s)	Date/Time
_____	_____	_____	_____
Electrically Qualified Person(s)	Date/Time	Electrically Qualified Person(s)	Date/Time

Authorized by : _____ _____ _____

Authorized Supervisor Date Time

Notes: _____

APPENDIX E

FLASH PROTECTION BOUNDARY

For system that are above 600 volts or less, the Flash Protection Boundary shall be 4.0 Ft, based on the product of clearing time of 6 cycles (0.1 second) and the available bolted fault current of 50 kA or any combination not exceeding 300 kA cycles (5000 ampere seconds).

For clearing times and bolted fault currents other than 300kA cycles, or under engineering supervision, the Flash Protection Boundary shall alternatively permitted to be calculated in accordance with the following general formula:

$$D_c = [2.65 \times MVA_{bf} \times t\ ]^{1/2}$$

Or

$$D_c = [53 \times MVA \times t\ ]^{1/2}$$

Where:

D_c = Distance in feet from an arc source for a second-degree burn

MVA_{bf} = bolted fault capacity available at point involved (in mega volt-amps)

MVA = capacity rating of transformer (mega volt-amp). For transformer with MVA rating below 0.75 MVA, multiply the transformer MVA rating by 1.25

t = time of arc exposure (in seconds)

At voltage levels above 600 volts, the Flash Protection Boundary is the distance at which the incident energy equals 5 J/cm2 (1.2 cal/cm2). For situations where fault-clearing time is 0.1 second (or faster), the Flash Protection Boundary is the distance at which the incident energy equals 6.24 J/cm2 (1.5 cal/cm2).

ATTACHMENT 2

GROUND FAULT PROTECTION ON CONSTRUCTION SITES

WORK PRACTICE GUIDELINE

1. Background

   A. OSHA standard 1926.404(b)(1) requires “ground fault protection” on construction sites. The standard allows two different approaches to providing the required protection for employees from electrical ground faults. Either “ground fault circuit interrupters” (GFCI) are to be used with temporary receptacles, or 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.

2. Ground Fault Circuit Interrupters

   A. 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.

   B. GFCIs may trip from many causes:

   - Electrical leakage in the tool from internal defects
   - Electrical leakage in the extension cord from 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
   - Electromagnetic interference from 2-way radios, or from power transmission lines
   - 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.

C. All 120-volt, single phase, 15 and 20 ampere temporary receptacles shall be protected with “approved” GFCIs. “Approved” means listed by Underwriters Laboratories.

D. There are several types of GFCIs.

- A combination circuit breaker and GFCI which is installed in place of the ordinary circuit breaker
- A receptacle containing a built-in GFCI
- A portable GFCI which 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

E. 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).

3. Assured Equipment Grounding Conductor Program

If an 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.

A. Temporary receptacles shall be electrically grounded in accordance with the temporary wiring requirements of the National Electrical Code.

B. Extension cords shall be three-wire cords, containing an equipment grounding conductor (ground wire).

C. Electrical equipment which 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.)

D. The Worksite Manager and/or Supervisor are required to designate one or more competent persons to administer this testing and recording program.

E. Periodic testing of all plug connected equipment, all extension cords, and all temporary receptacles is to be conducted at the following times.

(1) Before a new item (equipment, cord, or receptacle) is put into use

(2) After any repairs to the item

(3) After any incident in which the item may have been damaged

(4) Within 3 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 6 months.)

F. The purpose of the test is to determine the following:

(1) Temporary receptacles - To be sure the receptacle is grounded.

(2) Extension Cords - To be sure that ground wire is connected to the proper terminal, at each end, and the ground wire is continuous throughout the length of the cord.

(3) Plug Connected Equipment - To be sure the ground wire is connected to the proper terminal and to the non-current carrying metal parts of the equipment, and the ground wire is continuous from the equipment to the plug.

G. The tests may be conducted using the following instruments.

(1) A receptacle tester may be used to test receptacles, and to test extension cords when plugged into a receptacle.

(2) 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.

H. 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.

I. Color coding shall be used in the following manner.

(1) After a plug connected piece of equipment or an extension cord has 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.

(2) Any set of colors may be used, with the exception of white, black, or silver.

(3) 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

J. The 3 months tests 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 6 month tests, for those receptacles and extension cords only needing the semi-annual tests, are to be color coded using the quarterly color current at the time of the 6 month test.

K. A visual inspection of plug connected equipment, extension cords, and temporary receptacles are to be made by the user before each use. The purpose of the visual inspection is to look for damage or defects which could affect the safe use of the item. (Exception: extension cords and temporary receptacles which are fixed in place and not exposed to damage are not required to be give a daily visual inspection, but it is a good idea to do it anyway.)

L. Equipment, cords, or receptacles showing damage or defects which 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.

M. 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.

N. A copy of this program is to be kept at the worksite.

AECOM Elevated Work Platforms **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	602
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Provides the requirements to be followed when the use of elevated work platforms and aerial lift equipment are planned.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Elevating Work Platform (EWP) – Includes aerial lifts, scissor lifts, articulating boom lifts, truck platforms, and crane-suspended personnel platforms.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROJECT MANAGER (FIELD TASK MANAGER, SUPERVISOR)

The AECOM site management is responsible to see that sound principles of safety, training, inspection, maintenance, and operation consistent with all resource data available from the manufacturer, OSHA, and ANSI is provided to the operator and users.

The Supervisor has direct control over the use and operation of elevating work platforms. The Supervisor and the assigned operating personnel have the responsibility for proactive, safe employee behavior. Decisions about the use and operation of a EWP shall be made with due consideration that the equipment will be carrying personnel whose safety is dependent on those decisions.

It is the operator's responsibility to implement safe work practices provided by project management, supervision or the task leader supplemented by good judgment, safe control, and caution whenever evaluating personnel in a platform, bucket or basket. The safety of all personnel in the EWP is dependent on safe use and operation by the operator.

4.2 REGIONAL SH&E MANAGER

Provides technical guidance and support about this procedure.

4.3 SITE SAFETY COORDINATOR

The Site Safety Coordinator (SSC) shall assist the site manager in compliance with the requirements of this procedure.

4.4 EMPLOYEES

All employees engaged in project field activities shall follow these procedures.

5.0 PROCEDURE

5.1 GENERAL EQUIPMENT REQUIREMENTS

- Fall Protection – All employees on EWP shall wear and use a full body harness, fall arrest device and lanyard and be secured to the manufacturer's provided anchorage point at all times. Employees shall not secure themselves to a top handrail or the work structure.
- All aerial lifts shall be operated and maintained in accordance with manufacturer's specifications.
- All aerial lifts used by AECOM must be certified by the manufacturer to meet requirements of the American National Standards Institute (ANSI) standard applicable to the device:
  - For truck-mounted boom or scissor lifts – ANSI Standard 92.2.
  - For manually propelled boom or scissor lifts – ANSI Standard 92.3.
  - For self-propelled boom lifts – ANSI Standard 92.5.
  - For self-propelled scissor lifts – ANSI Standard 92.6.
- Lift controls on extensible and articulating boom platforms shall be clearly identified as to function.
- Aerial lifts designed as personnel carriers shall have both work platform (primary) and lift mount (secondary) controls. Primary controls shall be within easy reach of the operator. Secondary controls shall be capable of overriding the upper controls. All controls shall be plainly marked to identify their function.

5.2 OPERATOR TRAINING

EWP operators shall be trained and certified by a source approved by the SH&E Department (e.g., vendor / equipment rental company or an experienced staff operator). Documentation of training shall be maintained including the source, date, persons trained and outline of information in the project file.

The operator of the equipment shall review the work to be performed with the assigned staff including the work task(s), work zone set up, client requirements, any hazards, equipment controls, safety equipment, fall prevention, and coordination of the operation before undertaking the work.

5.3 OPERATOR SKILLS

Demonstration of operation skill and knowledge shall be accomplished at the time of operator training. A demonstration shall accompany any operator training to verify that the prospective operator possesses the actual skills to operate specific types of aerial lifts.

A memorandum to the project file shall be used to document that the operator demonstrated EWP skills to the vendor and / or responsible staff.

5.4 EQUIPMENT INSPECTION

Daily Pre-Operation Check - Before using lift equipment, the EWP shall be given a visual inspection and functional test on the following items by the operator:

- Operating and emergency controls
- Safety devices
- Personal protective devices, including fall protection
- Air, hydraulic and fuel system for leaks
- Cables and wiring harness
- Loose or missing parts
- Tires and wheels
- Placards, warnings, control markings, Operating Manual

- Outriggers, stabilizers, extendible axles, other structures
- Guardrail system, gate
- Other items specified by the manufacturer

The Aerial Lift Pre-Operation Checklist (Attachment 1) shall be completed prior to each day of operation. The checklist will be submitted to the supervisor or task leader with explanation of any noticed defects.

NOTE: Any problems or malfunctions that affect safe operation of the equipment shall be repaired prior to the use of the EWP

Periodic Inspection – Project management shall ensure that complete inspections scheduled in accordance with the manufacturer's recommendations are performed on the EWP. Periodic inspections shall be performed by the dealer or qualified mechanic familiar with such equipment designated by project management. Inspections shall include the use of the Equipment Inspection Form (Attachment II) or a similar inspection form provided by the vendor.

Post Incident Inspection – An inspection shall be conducted before continuing the operation of an EWP following any incident where the EWP has obvious or suspected operational damage. This special post incident inspection must be supported by communications to the dealer or manufacturer of the equipment requesting any additional specific inspection, maintenance checks or repairs.

Maintenance/Repairs – All maintenance and repairs shall be made by a qualified person in conformance with the manufacturer's recommendations. Scheduled maintenance may exceed the manufacturer's minimum requirements. EWP shall be immediately removed from service until repaired and their use discontinued any time there are problems or malfunctions that affect safe operation of the EWP.

Records of all inspections and maintenance on EWP shall be maintained by the project.

5.5 PLANNING FOR SAFE USE

To ensure that work risks are evaluated for the safe use of EWP and covered in user meetings, the following issues must be planned for and incorporated into the activity planning process.

- Identify the competent operator(s) who:
  - Has been trained by a qualified person (e.g., vendor / equipment rental company approved program or an experienced staff operator)
  - Has read and understands the manufacturer's operating instructions for the particular EWP intended to be used
- Conduct an on-the-job pre-operation check of the equipment and work zone for potential hazards in the intended work area. Possible hazards may include but not be limited to:
  - Drop-offs or holes and uneven terrain
  - Bumps and work surface obstructions
  - Debris, materials, tools
  - Overhead obstructions and high voltage conductors
  - Hazardous locations (e.g., vehicular traffic, train movement, operating units)
  - Inadequate surface and support to withstand all load forces imposed by the EWP in operating configurations
  - Wind and weather conditions
  - Presence of unauthorized persons
  - Evaluate swing radius for pinch/crush points and barricade needs
  - Working above or below other crews
  - Working on unstable surfaces (e.g., barges) where tie-downs are required

- Working over water

- Evaluate expected loading for platform and ensure that capacities for each specific configuration are within the manufacturer's limits. Include additional weight e.g., personnel and items to be used inside the basket
- Include in activity plans the appropriate emergency response/actions

5.6 EQUIPMENT OPERATION

Since the EWP operator is in direct control of the platform, conformance with safe work practices is the responsibility of the operator. The operator must make decisions about the use and operation of the EWP with due consideration that his/her own safety as well as the safety of other personnel in the platform is dependent on those decisions. During operation, the EWP shall be used in accordance with project requirements, manufacturer operation specifications and the following specific guidelines.

- On public highways and roadways, a safe work zone must be established in compliance with appropriate local, state and federal standards including Manual on Uniform Traffic Control Devices (MUTCD). In rail systems and airports, a safety work area shall be similarly established in conformance with client requirements and applicable standards
- The EWP must be operated on a surface within the limits specified by the manufacturer
- Lift controls shall be tested each day prior to use to determine that they are in safe working condition. Controls shall be plainly marked as to their function
- Outriggers, stabilizers, extendible axles or other stability enhancing means are used as required by the manufacturer, including whenever personnel are aloft
- Guardrails must be in a safe condition and access gate(s) or openings are closed per manufacturer's instructions
- The load and its distribution on the platform and any platform extension(s) are in accordance with the manufacturer's rated capacity for that specific configuration
- Adequate clearance from overhead obstructions is maintained
- Safe operating distances are maintained from all potentially energized (exposed or insulated) power lines and parts including temporary construction power lines/cord sets. (See SH&E SOP 727, Overhead Electrical Lines).
- Safe distances are maintained from all potential where a client’s moving equipment may be in transit and come in contact with an EWP or its parts. All client procedures, approval, permits and accompaniments shall be secured prior to operating an EWP
- Fall Protection – Each person in the platform must wear a full body harness and be secured to the manufacturer provided anchorage point at all times, not to the basket top handrail or the work structure
- Only essential materials and tools required to perform the work from the lift are in the platform and fit completely inside, taking into account total weight involved and the capacity of the equipment. Never exceed manufacturer’s rated load limits
- Personnel must stand firmly on the platform floor, and shall not sit or climb on the edge of the basket or use planks, ladders or other objects to gain a work position or as a climbing device
- Conduct a work area hazard evaluation prior to initiating any elevated platform work. Plan work accordingly
- When operating from a barge ensure that the EWP is positively secured to the barge deck by using tie down eyes and appropriate anchorage points. Anchorage needs to ensure that wheels remain firm on the barge deck. Use four-point tie down or equivalent method. Never secure to anything loosely lying on the barge deck
- Never use the EWP for hoisting, towing or pulling

- Never place heavy objects on hand rails or come in contact with objects that could damage railings or platform
- Immediately report any problems or equipment malfunctions occurring during operation to the Supervisor or task leader
- Do not continue to operate an EWP if unsafe conditions occur during operations.
- Never alter, disconnect or disable interlocks or other safety devices that would allow operation in violation of manufacturer's specifications
- Ensure care is taken to prevent entanglement in ropes, wires, cables, etc.
- The work area below EWP must be clear or barricaded from unauthorized person's entry (e.g., project personnel, pedestrians, traffic) traffic in case something is dropped from work platform
- Retract and lower the EWP boom to its lowest possible position, maintaining good view as it moves before attempting to move an EWP. Ensure that the path of intended movement is clear of debris and personnel. Use a spotter attendant in congested or hazardous areas. Equipment movement speed shall be limited to surface and safe condition in accordance with the manufacturer's recommendations. Watch for overhead obstructions
- Shut engine off during refueling and fuel only in well-ventilated areas free of other flammable/combustible materials
- Never travel or work on grades, side slopes or ramps exceeding those identified by the manufacturer
- Should an EWP become snagged or caught on a structure preventing normal operation/motion, personnel should be removed from the platform before attempting to free the platform using ground controls
- Never alter or modify an EWP without written permission from the manufacturer or leasing company
- Articulating boom and extensible boom platforms shall have both upper (platform level) and lower (ground level) controls. Lower controls shall override upper controls, but shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency
- Never attempt to operate an EWP from below (ground controls) when it is already in use, except in an emergency situation. Example: Employee is using EWP for access to upper levels where it requires operator to leave the work platform to do his/her work. The operator conducting work at upper levels that has to physically leave the lift platform must give approval for intermediate use. In such situations, the employee shall be secured with fall protective equipment 100% of the time using double lanyards if necessary
- No more than two people shall be in an EWP at any one time without approval of the Supervisor. Under no circumstances shall more than two people be allowed in the EWP if the manufacturer prohibits such a practice

5.7 AERIAL LIFTS

An aerial lift is a vehicle-mounted device used to elevate personnel to job sites above the ground. This includes extendible boom platforms, aerial ladders, articulating boom platforms, vertical towers, and combinations of these devices. It is not necessary that the device be able to rotate around a vertical axis to be classified as an aerial lift.

- Lift controls on extensible and articulating boom platforms shall be clearly identified as to function and tested each day to verify safe working condition. An overall visual inspection shall be completed to ensure cracked welds and/or structural damage does not exist. Defective equipment shall be reported to the supervisor and not used until repairs are completed.
- Aerial lifts shall be operated only by authorized persons.
- Employees working in baskets shall always stand on the floor of the basket and may not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

- The manufacturer's boom and basket load limits must not be exceeded.
- Brakes on aerial lifts shall be set when in use. When outriggers are used they must be placed on pads or on solid surfaces. When using aerial lifts on inclined surfaces, wheel chocks shall be used if they can be safely installed.
- Aerial lift trucks shall not be moved with employees in an elevated basket unless the equipment is specifically designed for this operation.
- Aerial lifts primarily designed as personnel carriers shall have both platform (upper) and lower controls. Upper controls shall be within easy reach of the operator. Lower controls shall override the upper controls. All controls shall be plainly marked to identify their function.
- Lower level controls shall not be operated without permission from the employee(s) in the lift except in case of emergency.
- Before moving an aerial lift for travel, the boom must be properly cradled and the outriggers stowed.
- Aerial ladders on ladder trucks and tower trucks shall be secured in the lower traveling position by the locking device on top of the truck cab, and the manually operated device at the base of the ladder before the truck is moved for highway travel.

6.0 REFERENCE MATERIAL

29 CFR 1910.67 - Vehicle Mounted Elevating and Rotating Aerial Devices

ANSI A92.2 (latest revision) – Vehicle Mounted Elevating and Rotating Aerial Devices

29 CFR 1926, Subpart V – Power Distribution and Distribution

SH&E SOP 727 – *Overhead Electrical Lines*

SH&E SOP 605 – *Fall Protection*

7.0 ATTACHMENTS

Attachment 1 – Aerial Equipment Pre-operation & Work Zone Checklist

Attachment 2 – Aerial Lift Equipment Inspection

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

Aerial Equipment Pre-Operation & Work Zone Checklist

CHECKLIST MUST BE COMPLETED DAILY PRIOR TO INITIAL OPERATION			
FAULTY EQUIPMENT / DEVICES WILL BE IDENTIFIED AND REPAIRED BEFORE USE			
☑ = Acceptable O = Needs Improvement ☒ = Not To Be Operated NA Not Applicable			
EQUIPMENT / VEHICLE ID #		**LOCATION:**	
DATE:		**OPERATOR NAME:**	
MARK CONDITION			**COMMENTS**
Parking Brake			
Brake Fluid Level			
Brakes Adjusted			
Tires Pressure & Condition			
Steering System			
Horn			
Seat Belts			
Muffler / Exhaust System			
Rear View Mirrors			
Fluid Levels			
Belts - Fan, Alternator			
Hydraulic Lines			
Ladders, Tools, Equipment			
OPERATING CONTROLS			
Turn Signals			
Brake Lights			
Emergency Lights			
Head & Tail Lights			
Gauges			
Platform Controls			
Reflectors & Labels			
Windshield Wipers			
Fire Extinguisher			
Back-Up Alarm			
Wheels Chocked			
Computer Functioning Properly			
Stabilizers Positioned			
Swing / Boom / Hoist Controls			
Travel Controls and Tracks			
Traverse Controls			
Elevation Controls			
WORK ZONE			
Platform Completely Enclosed			
Trained Operator			
Required PPE			
Fall Protection Equipment Used			
Cones, Barricades, Signage			
Establish Work Zone Per MUTCD			
Review Work Task(s) With Staff			
Traffic Directional Lights			
NOTE: WHEN VEHICLE IS NOT REQUIRED TO HAVE SPECIFIC ITEMS, IT MUST BE SHOWN AS N/A IN BOX			
THIS FORM MUST BE MAINTAINED IN THE PROJECT FILE			

AERIAL LIFT EQUIPMENT INSPECTION

AECOM

TYPE EQUIPMENT	EQUIPMENT NUMBER	SERIAL NUMBER
MAKE		MODEL NUMBER
MILEAGE	DATE CHECKED	LOCATION
ENGINE MAKE	YEAR MANUFACTURED	HOURS

	MARK ONE			COMMENTS
	GOOD	FAIR	REPAIR	(List percentage of wear on all wear items)
1. GENERAL APPEARANCE				
Hood & Panels				
Paint				
Undercarriage				
Tires – Type, Size				
2. ENGINE COMPARTMENT				
Oil Level & Condition				
Filters, Condition				
Fan / Radiator / Belts				
Gov. / Idling Device				
Exhaust System				
Fuel / Water / Oil / Lines				
Coolant – Level – Protect.				
Battery – Test Condition				
3. OPERATOR'S POSITION				
Controls				
Gauges				
Starting / Charging System				
Engine Condition				
- Minor Repair				
- Major Repair				
Decals & Labels				
4. Aerial equipment				
Boom Condition				
Wear Pads				
Power Trac				
Tires – Condition, Type				
- Right Front				
- Right Rear				
- Left Front				
- Left Rear				
Hydraulic Fluid & Filter				
Emergency Lowering				
Aux. Power System				
Scissor Arms				
Safety Circuits				
Control Labels				
Basket & Door				
Back-up Alarm				
Stabilizers				
Pads				
5. PARTS BOOK				
Operator's Manual				
Service Manual				
Fire Ext.				

	MARK ONE IN/OUT			COMMENTS
6. OTHER COMPONENTS	GOOD	FAIR	REPAIR	
SIGNATURES Inspected By: Approved By:				ESTIMATED HOURS TO REPAIR

AECOM	SH&E No.:	605
	Rev:	Original
Fall Protection **AECOM Safety, Health and Environmental Procedure**	Date:	October 5, 2009

1.0 PURPOSE

Provides the AECOM requirements for employees who perform work at heights of 6 feet or more above grade or other work surfaces for fall prevention and protection.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Anchor Point – A secure point of attachment for lifelines or lanyards, usually a building structural component, crane, or other support capable of holding a 5,400 pound static load.

Base Surface – The area immediately beneath an elevated structure or surface (ground, walking surface, floor, etc.). Used synonymously here with "grade."

Body Harness (Class III) – A tight fitting harness 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.

Climbing Protection System – A type of fall protection used on long ladders, poles and towers, which 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 which allows climbing freedom, but locks the instant a fall is sensed.

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., which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on an employee during fall arrest.

Fall Prevention – Any structure (e.g., a ladder cage or guardrail), fence, or barrier that will prevent falls during work at heights. A safety belt and short lanyard is also considered fall prevention.

Fall Protection – A personal lifeline system (e.g., harness and lanyard), deceleration device, and fixed anchor points or climbing protection system (e.g., permanent ladder rails) that limit falls to less than 6 feet.

Free Climbing – Climbing on a structure such as a ladder, tower, or chimney which is not equipped with guardrails, walls, a cage or other type of structural fall prevention. Free climbing generally requires the use of a fall protection system.

Grade – (see Base Surface).

Lanyard – A line connecting a safety harness or safety belt to a safety line or structure. When used with a safety belt, the lanyard must be short enough to prevent the employee from approaching the fall hazard.

Personal Lifeline System – A type of fall protection comprised of a body support (i.e., a safety belt or body harness) and lanyard which is attached to an anchorage point or a safety line.

Safety Belt (Class I) – A belt worn around the waist that when attached to an anchor point with a lanyard prevents a worker from approaching a fall hazard. Safety belts should not be used on AECOM projects other

than within the cage of a man or scissor lift without the prior approval of the Project Manager and the Regional Health and Safety Manager.

Safety Line – A rope or cable secured to one or more an anchor points to which lanyards may be attached to limit fall distance.

Standard Railing – Railing provided to enclose open-sided work platforms which consists of a top rail, intermediate rail, and posts. The top rail has a vertical height of 42 inches above the platform surface and the intermediate rail is approximately halfway between the top rail and the platform surface.

Work at Heights – Tasks performed from a platform or other working surface which is 6 feet or more above grade or the base surface.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROJECT MANAGER (INCLUDING FIELD TASK MANAGER, SUPERVISOR)

The Manager and Supervisor have primary responsibility for ensuring that work done at elevations is done safely. He/she is responsible for implementation of the requirements of this procedure. Some of the field manager's responsibilities include:

- Assuring that all personnel who perform work at heights are familiar with this procedure.
- Designating a competent person to monitor the safety of other employees and the employer shall ensure that the safety monitor complies with the following requirements.
- Assuring that all personnel are apprised of any site specific hazards prior to performing work more than 6 feet above grade.
- Assuring that required personal protective equipment (PPE) and/or personal lifeline systems are available on site as necessary.
- Maintaining a high level of health and safety consciousness among employees.
- Maintaining regular communications with field staff and the Regional SH&E Manager, as necessary.

4.2 COMPETENT PERSON

A competent person (see SH&E SOP 721 – *Designation of Competent Person*) will be designated to:

- Recognize fall hazards.
- Warn employees if they are unaware of a fall hazard or are acting in an unsafe manner.
- Be on same working surface and in visual sight.
- Stay close enough for verbal communication.
- Not have other assignments that would take monitors attention from the monitoring function.

4.3 REGIONAL SH&E MANAGER

The Regional SH&E Manager is the individual responsible for the, interpretation and, with the concurrence or the Corporate Health and Safety Manager, modification of this procedure. Modifications to this procedure which may result in less stringent precautions cannot be undertaken by the PM or the on-site personnel without the approval of the Regional SH&E Manager. Specific duties of the Regional SH&E Manager includes:

- Advising Field Task Managers and site personnel on matters relating to climbing safety or other work to be performed more than 6 feet above ground or base surface level.
- Recommending appropriate personal protective equipment (PPE) and climbing safety equipment to protect personnel.
- Working with the Manager to ensure that sufficient PPE and equipment is available.
- Performing field audits to monitor the effectiveness of this procedure and to assure compliance with it.

- Maintaining contact with Manager to regularly evaluate site conditions and new information which might require modifications to this procedure.
- Conducting training or briefings, when necessary, to apprise personnel of the contents of this procedure and site hazards.
- Investigating all incidents that resulted or could have resulted in an injury.

4.4 EMPLOYEES

This procedure will not be effective unless field employees and contractors make a conscientious effort to comply with it, and to exercise good judgment in all tasks. The following specific responsibilities are incumbent on field personnel:

- Obtaining a copy of this procedure and reading it prior to the start of on-site work.
- Using personal lifeline systems where appropriate and required.
- Bringing forth any questions or concerns regarding fall protection or this procedure to the Manager, Supervisor or Regional SH&E Manager.
- Complying with this procedure and good practice.

5.0 PROCEDURE

5.1 FIXED LADDERS

AECOM employees shall not climb fixed ladders on stacks, chimneys, tanks or other structures which are greater than 20 feet in length and which are not constructed as specified below:

- Fixed ladders, which are equipped with ladder cages, must be broken at 30 foot intervals which are offset from each other. Landing platforms, equipped with standard railings, must be provided at each 30 foot break in the ladder.
- Fixed ladders, which are not equipped with either ladder cages or climbing protection systems, must be broken and offset at 20-foot intervals. Landing platforms, equipped with standard railings, must be provided at each 20 foot break in the ladder. AECOM personnel who must free-climb such ladders, must be equipped with and utilize during the free climb portion, a personal lifeline system
- Fixed ladders on towers, water tanks, and chimneys, which are greater than 20 feet in unbroken length, may only be used if they are equipped with a climbing protection system. No landing platforms are required in these cases.

For fixed ladders less than 20 feet in length, the above regulations do not apply. However, AECOM employees who must free-climb and work off of such ladders at heights greater than four feet above the base surface, must be equipped with, and utilize, a personal lifeline system as described in section 5.7.4 of this SOP.

5.2 GENERAL

- All ladders used shall be heavy duty, non conductive, Type I ladders.
- The climber should always face the ladder when ascending or descending and both hands should always be used for climbing.
- Only one person is allowed to climb a portable ladder at a time.
- No ladder shall be used to gain access to a roof unless the top of the ladder extends at least 3 feet above the point of support at eave, gutter or roofline.

5.2.1 Stepladders

- Type I (industrial) stepladders shall not exceed 20 feet, Type II (commercial) stepladders shall not exceed 12 feet and Type III (household) stepladders shall not exceed 6 feet.
- Stepladders over 10 feet must be tied off to a support at the top or be held by another worker.

- Personnel must not stand on the cap or top step (i.e., the first step below the cap) of a stepladder.
- Stepladders should not be used as straight ladders.

5.2.2 Straight and Extension Ladders

- Straight and extension ladders shall be placed at such an angle that the base is one-fourth of the working length of the ladder out from the top support.
- All straight and extension ladders must be equipped with non-skid feet and must either be tied off to a support at the top or held by another worker while being climbed.
- Straight ladders shall not exceed 24 feet and extension ladders shall not exceed 40 feet in length.

5.2.3 Scaffolds

AECOM employees shall not climb or work on scaffolds that are not equipped with fall protection as specified below:

- All open sides on all scaffolds more than 10 feet above base surface must be equipped with standard railings.
- Access to the scaffold shall be by means of a secured ladder or other safe means. Free climbing of the scaffold structure is not permitted.
- Other information regarding the safe use of scaffolds can be found in SH&E SOP 603 - *Scaffolding*.

5.2.4 Elevated Work Platforms

See SH&E 602 – *Elevated Work Platforms and Aerial Lifts*.

5.3 TOWERS

AECOM employees shall not climb towers unless the tower has a fixed ladder which is equipped with fall protection or unless the employee is equipped with, and utilizes a personal lifeline system.

5.4 OTHER ELEVATED WORKING SURFACES

All other work at heights (i.e., work at elevation greater than 6 feet above the base surface), including activities conducted on:

• Tank Tops	• Temporary Staging	• Catwalks
• Roof Tops	• Bridges	• Other Work Platforms

Must either be performed on working surfaces which are surrounded on all open sides by standard railings or their equivalent, or by employees who are protected by a personal lifeline system as described below.

5.5 PERSONAL LIFELINE SYSTEMS

If fall protection normally provided by walls, floors, guardrails, scaffolds, and cages is absent during work at height, personal lifeline systems must be used. Personal lifeline systems typically consist of a body support (i.e., a safety belt or harness), an attached lanyard, and an anchorage point. Any equipment used for fall protection systems must meet the applicable ANSI and ASTM requirements for that equipment.

5.6 SAFETY BELTS AND HARNESSES

A Class I safety belt, often referred to as a body belt, is a device worn around the waist to which a lanyard is attached. It must only be used as a positioning device (form work), to restrict the employees' movement and prevent an approach to a fall hazard.

Safety belts are no longer approved for personal fall arrest systems (PFAS). Only a full body

harness may be used for this purpose.

A Class III safety harness, often referred to as a body harness or parachute harness, is a belt system designed to spread shock load over the body torso (shoulders, thighs and seat area). It must be used during free climbing or working above 6 feet.

5.6.1 Lanyards

A lanyard is a short, flexible rope or strap webbing which connects a worker's safety belt or harness to an anchorage point. Lanyards cannot exceed 6 feet in length. Length should be selected to allow appropriate freedom of movement while limiting the fall to as short a distance as possible.

A shock-absorbing lanyard is designed to absorb a portion of the shock as the lanyard becomes taut during a fall. They should be used for fall protection.

Lanyards should be replaced at the first sign of wear and after they have been subjected to a fall

5.6.2 Retractable Lifelines

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. The device is attached to an anchor point. This system allows a freedom of motion for the worker but stops a fall ***very rapidly.***

5.6.3 Anchorage Points

The anchorage point is the position on an independent structure to which the lanyard is attached. It should be capable of supporting a minimum 5,000-pound static load.

A typical anchorage point on a fixed ladder would be a ladder rung or support.

To limit the fall distance, lanyards should be attached to an anchorage point at or over the head.

5.6.4 Use of Personal Lifeline Systems for Free Climbing

The object of personal lifeline systems is that the wearer be attached, and thereby protected, at all times while performing work at heights. During tower and ladder climbing, where a ladder cage is not provided, a Class III safety harness and a two lanyard system must be utilized to assure continuous fall protection.

Using this method, the worker attaches the first lanyard to an anchorage point (e.g., ladder rung or tower brace) above his/her head and climbs until the anchorage point is at slightly below waist height. At that point, the worker attaches the second lanyard to an anchorage point over his/her head, detaches the first lanyard and repeats the process. By using this method, the worker is always attached during the climb.

5.6.5 Climbing Protection Systems

An alternative to the above method involves the use of a climbing protection system. A climbing protection system is a fall protection mechanism often installed on long ladders, chimneys, and towers. It incorporates a permanently attached rail or cable that runs the length of the ladder or tower. The climber's harness and lanyard is attached to the rail or cable by a sliding device or sleeve which allows climbing freedom, but locks the instant a fall is sensed.

Obviously, the use of such systems will typically be limited to those client facilities where climbing protection systems have been installed.

On new towers constructed by AECOM, climbing protection systems shall be installed at the time of construction, if technically and economically feasible.

5.6.6 Approvals, Inspection and Maintenance

- Body harnesses, lifelines, and lanyards must be approved by the manufacturer for the planned application.
- Such equipment will be in good condition and inspected prior to each day's work.

- Lanyards and safety lines which have been subjected to shock-loading as a result of a fall shall be replaced as a precaution to prevent potential failure.
- Modifications to personal lifeline systems which void their certification will not be made.

5.6.7 Fall Rescue Plan

A rescue plan must be developed for each specific project where *Personal Lifeline Systems* are utilized by AECOM employees. The plan must incorporate procedures that will assure prompt rescue in the event that an employee falls into a Personal Lifeline System. As a minimum, the rescue plan should address:

- Specific equipment and procedures to facilitate self-rescue, if applicable and appropriate;
- 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,
- Procedures for familiarizing the proposed rescues services with the potential rescue conditions.

5.7 PERSONNEL QUALIFICATIONS

All employees working on tasks that require the use of fall protection must have attended training on the selection, use, care, and limitations of fall protection equipment. Retraining will occur when the following conditions occur: 1) Deficiencies in training; 2) Work place changes; 3) Fall protection systems or equipment changes that render previous training obsolete.

No employee shall attempt to perform work which he/she has not been trained to safely perform, or which he/she considers unsafe, including specific activities involving work at heights.

Employees who regularly climb towers or stacks to heights in excess of 20 feet shall be active participants in the AECOM Medical Surveillance Program.

Records of training and medical surveillance exams will be maintained by the AECOM North America SH&E office.

In addition, 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 which may interfere with alertness or physical strength will not perform work at elevations. Project managers will not allow employees known to be experiencing personal or psychological stress to undertake work at elevations.

5.8 WORKING ALONE

All climbing or work at heights shall be carried out only in the presence of a co-worker or client employee who will be in visual and auditory range at all times during the critical phases of the work. This stand-by observer shall be able to make immediate contact with emergency services.

5.9 ENVIRONMENTAL CONDITIONS

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.

5.10 OTHER PROTECTIVE EQUIPMENT

Other required personal protective equipment, 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; rugged, safety shoes with heels, should be worn to provide protection as well as adequate support; gloves should be worn as needed.

5.11 TOOLS

All tools, equipment, and supplies provided or used by AECOM personnel shall be appropriate and in good condition; unsafe tools or equipment will not be used; tools and equipment will not be misused. Tools will be raised to the point of work via a tool lift, leaving the hands free for climbing. Electric tools will be battery operated or will have electrical power supplied through ground fault circuit interrupters (GFCI).

5.12 VISUAL INSPECTION

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.

5.13 GENERAL

If there is a question of unacceptable risk in working at any elevated work station, the work shall not be done until such questions are dealt with. Alternatives to climbing (elevators, aerial lifts, etc.) shall be used when practical.

5.14 EMERGENCY REFERENCES

Prior to commencement of work to be conducted more than 6 feet above grade, the on-site personnel shall identify the nearest clinic or hospital. The phone number and directions to this facility shall be recorded and kept available on site.

No AECOM employee shall climb alone. A stand-by person, who can immediately contact emergency services, must be in visual and voice contact with the climber.

5.15 FALL PROTECTION PLAN

All projects with unprotected fall hazards greater than 6 feet must have a Fall Protection Plan written and provided to the workers exposed to the fall hazard. This plan may be attached to or included in a Health and Safety Plan for the project. The plan and any changes to the plan shall be approved by a qualified person.

- A copy of the fall protection plan with all approved changes shall be maintained at the job site.
- The implementation of the fall protection plan shall be under the supervision of a competent person.
- The fall protection plan shall document the reasons why the use of conventional fall protection systems (guardrail systems, personal fall arrest systems, or safety nets systems) is infeasible or why their use would create a greater hazard.
- The fall protection plan shall include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection from the conventional fall protection systems. For example, the employer shall discuss the extent to which scaffolds, ladders, or vehicle mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling.
- The fall protection plan shall identify each location where conventional fall protection methods cannot be used. These locations shall then be classified as controlled access zones.
- Where no other alternative measure has been implemented, the employer shall implement a safety monitoring system.
- The fall protection plan must include a statement which provides the name or other method of identification for each employee who is designated to work in controlled access zones. No other employees may enter controlled access zones.

6.0 REFERENCE MATERIAL

SH&E SOP 602 – Elevated Work Platforms

SH&E SOP 603 – Scaffolding

SH&E SOP 602 – Elevated Work Platforms and Aerial Lifts

SH&E SOP 603 – Scaffolding

SH&E SOP 725 – *Climbing Inspections of Structures*

7.0 ATTACHMENTS

None

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

AECOM Manual Lifting **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	607
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Provides the requirements for use when performing manual materials handling (e.g., lifting/handling of items or materials) activities.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations. .

3.0 DEFINITIONS

Manual Materials Handling – Moving or handling things by lifting, lowering, pushing, pulling, carrying, holding, or restraining.

Team Handling – Team handling occurs when more than one person is involved during the lift.

4.0 ROLES AND RESPONSIBILITIES

4.1 DISTRICT/OFFICE/PROJECT MANAGER/FIELD TASK MANAGER/SUPERVISOR

Operations Managers will effectively implement the lifting weight limit for employee safety and provide direction on proper lifting/handling techniques.

4.2 REGIONAL SH&E MANAGER

- Assist in identifying activities with a high potential for lifting/handling strains and injuries
- Develop measures to mitigate potential strains/injuries during manual materials handling activities identified as having a high potential for causing lifting/handling strains and injuries
- Provide training on proper lifting/manual materials handling techniques

4.3 EMPLOYEES

- Employees shall follow this procedure.

5.0 PROCEDURE

5.1 GENERAL REQUIREMENTS

Mechanical equipment or assistance such as dollies, carts, come-alongs, or rollers are preferable to be used whenever possible rather than the employee physically moving materials. Mechanical assistance must be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping. The following guidance will be observed:

- Before performing a lift:
  - Check to see if mechanical aids such as hoists, lift trucks/dollies, or wheelbarrows are available.

- Be sure that you can lift the load without over-exertion knowing one's own physical capabilities and medical limitations. Get help with heavy or awkward loads.
- Be sure that the load is "free" to move.
- Check that the planned location of the load is free of obstacles and debris.
- Be sure that the path to the planned location of the load is clear. Grease, oil, water, litter and debris can cause slips and falls.
- Particular handling and lifting techniques are needed for different kinds of loads or materials being handled (for example, compact loads, small bags, large sacks, drums, barrels, cylinders, sheet materials like metal or glass). See Section 5.2 for additional guidance.
- Do not lift if you are not sure that you can handle the load safely.

- General tips for lifting:
  - Prepare for the lift by warming up the muscles.
  - Stand close to the load and face the way you intend to move.
  - Use a wide stance to gain balance.
  - Be sure you have a good grip on the load.
  - Keep arms straight.
  - Tighten abdominal muscles.
  - Tuck chin into the chest.
  - Initiate the lift with body weight.
  - Lift the load as close to the body as possible.
  - Lift smoothly without jerking.
  - Avoid twisting and side bending while lifting.
- Engineering Controls:
  - Material handling tasks should be designed to minimize the weight, range of motion, and frequency of the activity.
  - Alter the task to eliminate the hazardous motion and/or change the position of the object in relation to the employee's body -- such as adjusting the height of a pallet or shelf.
  - Work methods and stations should be designed to minimize the distance between the person and the object being handled.
  - High-strength push-pull requirements are undesirable, but pushing is better than pulling. Material handling equipment should be easy to move, with handles that can be easily grasped in an upright posture.
  - Workbench or workstation configurations can force people to bend over. Corrections should emphasize adjustments necessary for the employee to remain in a relaxed upright stance or fully supported seated posture. Bending the upper body and spine to reach into a bin or container is highly undesirable. The bins should be elevated, tilted or equipped with collapsible sides to improve access.
  - Repetitive or sustained twisting, stretching, or leaning to one side are undesirable. Corrections could include repositioning bins and moving employees closer to parts and conveyors.
  - Store heavy objects at waist level.
- Whenever possible, utilize hand holds or other lifting attachments on objects being handled:

- Use the “hook grip” on loads with cut-out handholds.
- Curl your fingers around the edge.
- Do not hold the load with fingertips.
- Use containers with handles located more than halfway up the side of the container.
- Use the “ledge grip” to handle regularly shaped objects without handles.
- Use vacuum lifters to handle sheet materials or plates.
- Hold the object with hands placed diagonally.
- Wear gloves where practical.

- When significant, sustained lifting work is required it is desirable to rotate employees to spread the work load among several people and avoid fatigue. Rotation is not simply performing a different job, but must be a job that utilizes a completely different muscle group from the ones that have been over-exerted.

5.2 SPECIFIC HANDLING TECHNIQUES

The following guidance will be used when performing manual materials handling for various types of materials.

5.2.1 Square or Rectangular Objects

To lift square or rectangular objects:

- Place one foot slightly in front of the other.
- Squat as close to the object as possible.
- Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.
- Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight, and tuck in the chin.
- Test to be sure the object is loose from floor and shall lift without snagging.
- Straighten the legs, keeping the backbone straight, pull the object into the body, and stand up slowly and evenly without jerking or twisting.
- If turning or change of direction is required, turn with feet without twisting the torso and step in the direction to travel.
- To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object and the surface on which the object is set.

5.2.2 Cylindrical Objects

When lifting/moving round or cylindrical objects, the objects should be rolled wherever possible. Rolling must be controlled by chute, tagline, or other means of limiting acceleration. Workers must not be positioned downhill from rolled objects. Use of the legs for pushing and tagline control of rolled objects must be stressed.

Cylindrical objects, such as drums that must remain upright, are to be handled manually by slightly tilting the object, using the legs for control, and balancing the object on the bottom edge. The handler then walks besides the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus, maintaining the balance and a steady controlled forward motion. Motion must be controlled so that stopping walking and moving the hands shall stop forward motion.

Use carts or tracks to transport cylinders. Make sure that two people transport a cylinder if carts cannot be used, use lifting straps to improve grip.

Technique for one person lifting a cylinder onto a platform:

- Roll the cylinder to within 3 feet of the platform.

- Position the forward foot around the cylinder, the back foot about 1 foot behind the cylinder.
- Bend knees slightly.
- Place one hand on the valve protective cap, the other hand underneath the cylinder about 1 foot from the ground.
- Tilt the cylinder onto the thigh of the back leg.
- Balance the cylinder on the thigh by pressing down with the back hand while lifting the cylinder with the forward hand.
- Extend both knees to initiate and forward movement of the cylinder and continue by pushing up and forward with the arms until the cylinder is located on the platform.
- Climb on the platform.
- Straddle the cylinder at the valve end.
- Grasp the valve protective cap of the cylinder with both hands between the thighs.
- Lean forward and straighten the knees to set the cylinder upright.

5.2.3 Bags and Sacks

The best way to handle a bag depends on its size, weight and how far it is to be carried. When lifting, remember to:

- Straddle the end of the bag.
- Bend the hips and knees.
- Keep the back straight.
- Grasp the bag with both hands under the closer end. Keep elbows inside the thighs.
- Lean forward, straightening the knees to set the bag upright.
- Readjust the straddle position moving feet closer to the bag.
- Readjust the grasp, with one hand clasping the bag against the body and the other under it.
- Stand up by thrusting off with the back leg and continuing in an upward and forward direction.
- Thrust the bag up with the knee while straightening the body.
- Put the bag on the shoulder opposite the knee used to thrust the bag up.
- Stabilize the bag on the shoulder.
- Move off without bending sideways.

Avoid unloading a bag from the shoulder directly to floor level. Use an intermediate platform or get help from a coworker.

- Stand close to the platform.
- Place one foot in front of the platform.
- Bend hips and knees.
- Keep the back straight.
- Ease the bag off the shoulder and put it upright on the platform.
- Pull the bag slightly over the edge of the platform.
- Stand close to the platform with the bag touching the chest.

- Clasp the bag against the body with one hand, the other hand holding bottom of the bag.
- Step back.
- Bend hips and knees, keeping back straight.
- Ease the bag on the floor.

Bulkier sacks are easier to carry on your back. Lift the sack onto your back from a platform:

- Move the sack to the edge of the platform.
- Put your back against the sack.
- Grasp with both hands on the upper corners of the sack.
- Ease the sack onto the back, bending hips and knees before taking the weight.
- Keep the back straight.
- Stand up and straighten the hips and knees.
- Stabilize the sack.
- Move away without bending sideways.

Two-person handling of a sack:

- Position one person on either side of the sack.
- Squat with one foot balancing behind the sack.
- Keep back straight.
- Grasp with the outer and on the upper corner, the other holding the bottom of the sack.
- On one person's command:
  - Stand up and straighten the hips and knees.
  - Move towards the stack.
  - Put the sack on the stack.

5.2.4 Sheet Materials

When lifting sheet materials:

- Stand close to the pile of sheets in a walking stance.
- Grasp sheet firmly at the mid-point of its long side with the closer hand.
- Pull sheet up and toward the body.
- Change grip using your other hand and put your fingers on top of the sheet.
- Pull sheet up to the vertical position and to the side until one half is off the pile.
- Grasp the lower edge of the sheet with the free hand and support the hand by placing it on your knee.
- Stand up without bending and twisting body.
- Whenever moving sheet materials, one must be cognizant of wind conditions.

To carry sheets:

- Use drywall carts to carry sheet materials.
- Get help from another person where carts are not available.

- Apply carrying handles for manual carrying.
- Always use gloves and carrying handle for glass and other materials with sharp edges.

Use team lifting and carrying where other solutions are inappropriate.

- Remember that the combined strength of the team is less than the sum of individual strength.
- Select team members of similar height and strength.
- Assign a leader to the team.
- Determine a set of commands to be used such as "lift", "walk", "stop", and "down". Make sure that everyone knows what to do when they hear the command.
- Follow the commands given by the team leader.
- Practice team lifting and carrying together before attempting the task.

5.3 MATERIAL STORAGE

When storing materials on site:

- Store materials at a convenient height.
- Leave the lowest shelf unused if necessary.
- Use vertically mobile shelves to avoid bending and overhead reaching.
- Use bin racks for storing small items.
- Store heavy and frequently used materials at waist height.
- Do not store materials at floor level.
- Use hand trucks with elevating devices in storage and loading areas.
- Use trucks with a tilting device to avoid bending.
- Use elevating platforms to avoid overhead reaching.

6.0 REFERENCE MATERIAL

SH&E SOP 608 – *Handling Drums and Large Containers*

7.0 ATTACHMENTS

None

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

AECOM	SH&E No.:	No. 705
	Rev:	Original
Highway and Road Work **AECOM Safety, Health and Environmental Procedure**	Date:	October 5, 2009

1.0 PURPOSE

To address potential hazards that may occur during highway construction and during work within the right of way of a public or private roadway.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

- **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.
- **Traffic areas** – Any work area where workers are located within 20 feet of moving traffic, existing or anticipated.
- **Traffic Control Plan** – A written document containing drawings and text that describes the physical controls to be established to isolate workers from moving vehicles.

4.0 ROLES AND RESPONSIBILITIES

Project/Lead Manager or Resident Engineer – Responsible for administering the procedure and determining 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 within the contract. The Lead Manager will also see that employees assigned to work in traffic areas are trained in the use of traffic control systems and PPE.

Site Safety Coordinator – Responsible to the lead manager concerning the implementation of safety and the internal traffic control plan within a highway construction/demolition worksite.

Regional SH&E Manager – Will be available for clarification and advice about AECOM standards.

AECOM Employees – Are required to abide by these procedures.

5.0 PROCEDURE

5.1 TRAFFIC CONTROL PLAN

Transportation incidents and workers struck by vehicles or mobile equipment account for many fatal construction work injuries. Workers in highway construction activities including flagging, demolition, surveying, utility, clean-up, emergency responders, and others in areas where there are moving vehicles and traffic are exposed to being struck by moving vehicles. Work zones are used to move traffic in an approved direction and are typically identified by signs, cones, barrels, and barriers.

The procedures appropriate for work in traffic areas will vary depending on the work environment. Very simple procedures are needed in an inactive parking lot and more complex procedures are needed when working in a

construction zone on a highway. Each AECOM project team shall prepare a project HASP addressing traffic controls and worker protection appropriate for the team's project and exposures. Plans shall address the following if applicable:

- Attenuator Vehicles
- Closures within a Closure
- Communications
- Driving – Seatbelts and rollover protection should be used on equipment and vehicles as stated by the manufacturer
- Flagging
- Lighting
- Night Operations and Work within Traffic Controls
- Personal Protective Equipment
- Sanitation
- Signage
- Traffic Control Devices
- Traffic Control Plans and Permits
- Training
- Work Zone Protections – Various styles of concrete, water, sand, collapsible barriers, crash cushions, and truck mounted attenuators are available to limit motorist intrusions into the construction work zone
- Worker – Heavy Equipment Interface

There must be a Traffic Control Plan for the movement of vehicle in areas where there are also workers conducting other tasks.

Drivers, workers-on-foot (WOF), and pedestrians must be able to see and understand the routes they are to follow.

Where there are several projects, coordinated vehicle routes and communication between contractors will reduce vehicular struck-by incidents.

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.

Other requirements for supporting activities such as excavations, heavy equipment usage, personal protective equipment, etc. shall be applicable and addressed in accordance with other appropriate procedures in this manual.

5.2 SIGNAGE

Standard highway signs for information, speed limits, and work zones will assist drivers in identifying designated traffic paths.

Provide appropriate instructional signage such as: EVACUATION ROUTE; DO NOT ENTER; REDUCED SPEED AHEAD; ROAD CLOSED; and NO OUTLET.

Using standard highway signs for internal construction worksite traffic control will assist workers in recognizing the route they are to use at the construction site.

5.3 TRAFFIC CONTROL DEVICES

Standard traffic control devices, signals and message boards will instruct drivers to follow a path away from where work is being done.

The authority in charge will determine the approved traffic control devices such as cones, barrels, barricades and delineator posts that will be used as part of the traffic control plan.

These standard devices should also be used inside the work zone.

5.4 WORK ZONE PROTECTIONS

Various styles of concrete, water, sand, collapsible barriers, crash cushions and truck mounted attenuators are available to limit motorist intrusions into the construction work zone.

All AECOM staff shall be made aware of controls established by the Contractor.

AECOM staff shall wear the required safety equipment at all times including a hard hat, work boots and eye protection and high visibility safety vest as a minimum and observe all project rules and requirements.

In the absence of a contractor, when AECOM staff are in the field alone e.g., investigations, surveys, etc., all appropriate DOT traffic control standards and devices shall be observed and placed in position.

The work zone shall be made safe by its separation from traffic.

5.5 FLAGGING

Flaggers and others providing temporary traffic control should wear high visibility clothing with a background of fluorescent yellow-green or orange-red and retro reflective material or white, silver, yellow-green, orange or yellow.

In areas of traffic movement, this personal protective equipment will make the worker visible for at least 1,000 feet, so that the worker can be seen from any direction, and make the worker stand out from the background. Check the label or packaging to ensure that the garments are performance Class 2 or 3 (may be project-specific).

Drivers should be warned in advance with signs that there will be a flagger ahead.

Flaggers should use STOP/SLOW paddles, paddles with lights, or flags (flags should be used only in emergencies.). The STOP sign should be octagonal with red background and white letters and border. The SLOW sign is the same shape, with an orange background and black letters and a border.

5.6 LIGHTING

Flagger stations should be illuminated. Lighting for workers on foot and equipment operators is to be at least 5 foot-candles or greater.

Where available lighting is not sufficient, flares or chemical lighting should be used.

Glare affecting workers and motorists should be controlled or eliminated.

5.7 TRAINING

Flaggers should be trained/certified and use the signaling methods required by the authority in charge.

WOF, equipment operators, and drivers in internal work zones need to know the routes that construction vehicles will use.

Equipment operators and signal persons need to know the hand signals used on the worksite.

Operators and WOF need to know the visibility limits and the "blind spots" for each vehicle on site.

WOF should wear high visibility safety garments designated as Class 1, 2 or 3.

Workers should be made aware of the ways in which shift work and night work may affect their performance.

5.8 DRIVING

Seatbelts and rollover protection should be used on equipment and vehicles as stated by the manufacturer.

When pulling off to the side of the road, AECOM personnel will park their vehicles at minimum of 20 feet or the width of two traffic lanes from moving traffic.

5.9 NIGHT OPERATIONS AND WORK WITHIN TRAFFIC CONTROLS

Operations with night activities will have a written plan that addresses the safety issues of working at night. The plan will address, but is not limited to:

- **Reflectivity**
  - All equipment used in the work zone shall have DOT-approved 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 will be replaced
  - Personnel working at night will have reflective tape on their hardhats and will wear retro-reflective vests at a minimum. The reflective bands on vests will be vertical and horizontal around the entire upper body.
  - Additional measures such as white disposable coveralls, reflective bands, and personal battery-operated strobe lights may be used when practical.
- **Illumination**
  - Whenever feasible and practical, light plants will be used to illuminate the work area.
  - On mobile operations, additional lighting on equipment may be used to illuminate the work area.
  - All equipment shall, at a minimum, have working strobe or warning beacon lights.
  - All equipment shall have working lights confirmed through daily visuals.
  - All flag persons will be placed in illuminated areas only.
  - All lighting is to be checked after setup to ensure that it is not blinding approaching traffic or other equipment in the work zone.
- **Hazard Analysis and Communication**
  - Prior to the start of any night operation, a detailed Hazard Analysis will be made addressing the possible hazards of night work. The Hazard Analysis will be reviewed with the crews and updated as needed. At the start of each shift, the Daily Safety Reminder will be used to reaffirm the provisions of the night work requirements as found in the hazard analysis and this policy.
  - The hazard analysis 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 will be used to call for help

5.10 ATTENUATOR VEHICLES

Although not required, it is good construction practice to place an attenuator truck or pick-up truck (minimum) immediately ahead of workers in a work zone.

The vehicle of choice should be placed to provide the best protection for workers.

The tires should be placed so that when struck they will turn away from workers.

5.11 CLOSURES WITHIN A CLOSURE

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 per hour.

Signs are to be installed approximately 250 feet 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 rotating beacon placed on the roof of the vehicle.

6.0 REFERENCE MATERIAL

Manual on Uniform Traffic Control Services, U.S. Department of Transportation-Federal Highway Administration, for traffic control safety guidance

49 CFR Transportation, Federal Highway Administration

State DOT requirements

7.0 ATTACHMENTS

Attachment 1 – Signs, Signals, Tags, and Barricades Checklist

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

ATTACHMENT 1

Signs, Signals, Tags, and Barricades Checklist

Name of Contractor: _____

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	Deficiency Corrected? OK	N/A
Are accident prevention signs, tags clearly visible?	☐	☐	☐	☐
Are danger signs used where immediate hazards exists?	☐	☐	☐	☐
Are caution signs used to warn against potential hazards or to caution against unsafe practices?	☐	☐	☐	☐
Are exit signs posted at all exit locations?	☐	☐	☐	☐
Are proper visual warning signs posted prior to (in advance of) the work area?	☐	☐	☐	☐
Are flaggers provided when signs, signals, and barricades to provide the necessary protection?	☐	☐	☐	☐
Are flaggers using red lights when signaling during periods of darkness?	☐	☐	☐	☐
Are flaggers wearing highly visible warning garment?	☐	☐	☐	☐
Are the flaggers trained in proper flagging procedures?	☐	☐	☐	☐
Are warning garments worn at night reflectorized?	☐	☐	☐	☐
Are highly visible flags used by the flaggers at least 18 inches square?	☐	☐	☐	☐
Are barricades used to totally obstruct the passage of people and vehicles to protect the work area?	☐	☐	☐	☐
Barricades meet the requirements set forth in the Manual of Uniform Traffic Control Devices? (MUTCD)	☐	☐	☐	☐

COMMENTS:

_____

_____

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AECOM Hazardous Energy Control (Lockout/Tagout) **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	712
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Establishes the requirements for AECOM employees to perform hazardous energy control (equipment lockout and tagout (LOTO) operations.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

All AECOM work is regulated by this procedure when:

- Any employee (or contractor) is required to remove or bypass a guard or other safety device.
- 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.

3.0 DEFINITIONS

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 lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed

Authorized Employee – A person who locks out or tags out a machine or piece of equipment in order to perform servicing or maintenance on that machine or equipment.

Cord and Plug-connected Equipment – Equipment where the only energy source is electrical power provided by a plug-in connection

Energy Source – Any electrical, mechanical, hydraulic, pneumatic, chemical, radiation, thermal, or compressed gas energy source; 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.

Energized – Connected to an energy source or containing residual or stored energy

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.

Energy Source – Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

Isolation – A physical activity using a device which 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.

Locking Device – A device that utilizes a lock, key, and identification number to hold an energy isolation device in the safe position for the purpose of protecting personnel.

Lockout – The use of a locking device to ensure that an energy-isolating device and the equipment it controls cannot be operated until the lockout device is removed.

Lockout/Tagout Specific Procedure – A written procedure developed specifically for each piece of machinery or equipment capable of unexpectedly releasing energy. This procedure outlines in detail how lockout/tagout will be performed.

Normal Production Operations – The utilization of a machine or piece of equipment to perform its intended production function.

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.

Tagout – The use of a warning device to establish that an energy-isolating device and the equipment it controls may not be operated until the tagout device is removed.

4.0 ROLES AND RESPONSIBILITIES

4.1 REGIONAL AND DISTRICT OPERATIONS MANAGERS

- Provide LOTO training to employees engaged in projects covered by this procedure
- Assure that Project Managers are preparing and implementing LOTO procedures on their projects

4.2 PROJECT MANAGER

Project/Lead Manager or Resident Engineer on the project is responsible for administering the procedure including:

- Determining whether client employees or AECOM employees will be responsible for implementing any required lockout/tagout of energy sources at client facilities
- Consulting with the SH&E Department regarding project specific requirements for lockout/tagout
- Informing the field team about the client or facility's requirements for lockout
- Ensuring that if AECOM is responsible for lockout/tagout, that only authorized employees work on or near equipment requiring hazardous energy control
- Assuring that the written LOTO procedure in effect on a project is audited at least annually including the observation of workers performing the procedure

4.3 SUPERVISORS

- Assure that all employees under their direction are fully aware of, understand, and adhere to the Lockout/Tagout procedures.

4.4 AUTHORIZED EMPLOYEES

- Verifying with the Project Manager who is responsible for LOTO at client facilities
- Obtaining a lock, key and tags
- Meeting with the facility representative and affected employees to review the LOTO activities
- Implementing project specific LOTO procedures

4.5 AFFECTED EMPLOYEES

- Assist Authorized Employees with the safe shutdown and restart of equipment
- Assure that no attempt is made to restart equipment without the knowledge of all employees performing work on the equipment

4.6 ALL EMPLOYEES

- Refrain from making any attempt to restart equipment that is locked or tagged out.
- Avoid areas where other employees are working on equipment

5.0 PROCEDURE

5.1 GENERAL PROCEDURES

- LOTO of energy sources must be performed only by an Authorized Employee. If more than one employee is involved, either each individual Authorized Employee must use his/her own lock (multiple lockout), or a group lockout may be performed by the employees' supervisor/foreman.
- The locks, tags, and equipment shall not be tampered with by any employee.
- Only the person placing the lock and tag the equipment may remove the lock and tag.
- If the employee who placed the lockout/tagout device/sign subsequently no longer works for the company, or cannot be located, only the authorized supervisor/foreman can remove the locks and tags in accordance with the procedure outlined below for Removal of Unattended Lockout/Tagout Devices.

5.1.1 Authorized Employees

Only employees that have completed training for Lockout/Tagout Authorized Employees will be permitted to perform work under Lockout/Tagout procedures. Each Authorized Employee will also be responsible for reviewing any applicable equipment-specific Lockout/Tagout procedure prior to initiating work. Any problems identified with the equipment-specific procedure are to be immediately reported as an incident or near miss and should be brought to the attention of the SH&E Department and all work on affected equipment halted.

5.1.2 Shift Change Procedures

If ongoing work requires carryover from shift to shift, or transfer of responsibility between employees, the following procedure will be implemented:

- The employee(s) who originally performed the lockout shall walk through the lockout/isolation steps with the new worker.
- At each isolation point the original worker shall remove his/her lockout/tagout device(s), to be immediately replaced by the new worker's device(s).
- Upon transfer of the lockout/tagout equipment, the new employee shall verify that the equipment is still isolated prior to continuation of work.

Under no circumstances shall the original devices remain in place and just the keys transferred. For supervisor/foreman and/or group lockouts, the same procedure shall be used with the oncoming supervisor/foreman.

5.1.3 Removal of Unattended Lockout/Tagout devices

Only the person(s) who placed the lockout/tagout devices on the system can remove the devices, unless:

- The Project Manager has verified that the 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 employee to verify that the work is complete and the devices are about to be removed.
- The Project Manager inspects the locked-out/tagged-out device and ensures that the equipment is capable of being safely re-energized.

If all of the above apply, the locks and tags can be removed at the direction of the Project Manager. The Project Manager shall complete an AECOM Lock and Tag Removal Form (Attachment 1) to document the event prior to removing the lock and file the form with the project records. A copy of the form shall be sent to the SH&E department member with oversight responsibility for the project.

UNAUTHORIZED REMOVAL OF A LOCKOUT/TAGOUT DEVICE WILL RESULT IN IMMEDIATE DISMISSAL FROM THE PROJECT SITE AND POTENTIAL TERMINATION!

5.1.4 Emergency Lock Removing Procedures

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.

In an emergency event that requires a lock or tag to be removed by a person other than the person who placed the lock or tag, the following lock-removing procedure will be implemented by another Authorized Employee:

- Investigate and verify that all equipment and material in relation to the work has been completed and/or put into a safe configuration.
- Ensure all personnel have been removed from the hazardous location and Affected Employees on site are notified.
- Remove lock.
- Attempt to contact the person that originally provided LOTO to advise him that the LOTO has being removed.
- Complete the Emergency LOTO Removal Form (Attachment 4). The Emergency Lock Removal Forms will be placed in the project files and send a copy to the SH&E department member with oversight responsibility for the project.
- Whenever a LOTO is removed for emergency purposes by anyone other then the employee who placed the LOTO, that person and all affected personnel must be contacted prior to the start of their next shift to inform them that the equipment/system is no longer locked out/tagged out.

5.2 SPECIFIC LOTO PROCEDURES

Written procedures will be developed for the lockout and tagout of each piece of equipment that has potentially hazardous energy sources (except as noted below). Each procedure must be reviewed and approved by the SH&E Department prior to implementation.

Equipment-specific written lockout/tagout procedures are not required, if ALL of the following conditions are met:

- The equipment's only energy source is electrical; and
- 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.

Additionally, equipment-specific Lockout/Tagout 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); and,
- The machine has a single energy source that can be readily identified and isolated (if more than one energy source is present (e.g., gas and electric), then written procedures shall be developed); and,
- The isolation and locking out of the single energy source completely de-energizes and deactivates the equipment; and,
- Servicing of the machine requires that its energy source must previously have been locked out and tagged out in accordance with this section; and,
- A single lock-out device achieves a locked-out condition.

5.2.1 Procedure Outline

All equipment-specific Lockout/Tagout procedures will be prepared to meet the following steps:

- Identify type and magnitude of energy.
- Notify affected employees that the machine/equipment will be shut down and locked out for servicing.

- Shut down machine/equipment by normal stopping procedure.
- Identify all energy-isolating device(s) for the machine or equipment being serviced.
- Lock out each device with individual locks. Tag out only if a device is not capable of being locked out.
- Relieve or restrain stored and/or residual energy.
- Verify the isolation of equipment and its zero energy state (attempt to restart the equipment.)
- Establish that energy to the equipment being worked on was isolated.
- Complete the LOTO Verification Checklist (Attachment 2)
- Perform work.
- Check work area to remove non-essential items and ensure equipment components are intact.
- Check work area to ensure all personnel are removed from the area.
- Verify that the controls are in neutral (off).
- Remove lockout device(s).
- Notify affected employees that the machine/equipment is ready for use.
- Reenergize the machine or equipment

Attachment 3 is provided as a template for preparing equipment–specific Lockout/Tagout procedures.

5.3 NON-SPECIFIC LOTO PROCEDURES

In the absence of an equipment-specific LOTO procedure, the following procedures, in combination with a completed Task Hazard Analysis (or Job Safety Analysis), can be used as an acceptable substitute.

5.3.1 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., presses, elevated vehicles).
- Determine which of these sources requires isolation to perform the work.
- Determine the locations where each energy source for that 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. You must then either unplug the equipment or find, close, and lock out the circuit breaker or electrical switch supplying the machine.
- Make sure anyone in the area knows you are about to turn off and lock out the equipment, and then close the isolation devices. Once closed, lock out the isolation devices so they cannot be inadvertently opened.
- Place an appropriate tag on each lock out device, with the appropriate warning (e.g., Do Not Open, Do Not Start) with date and time of isolation and a means of identifying who has performed the lockout.
- Once everything is locked out, verify that the isolation was successful by following manufacturers' directions or standard trade practice. Means of determining whether isolation was successful include:
- Try to turn the equipment on.
- Use pressure relief valves.
- Try to ignite the pilot light.
- Complete the LOTO Verification Checklist (Attachment 2)
- Perform the necessary work.
- Ensure all tools and parts are removed from the work area.
- Remove the tags and locks 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 personnel in the area that the lockout/tagout systems have been removed.
- If additional work is required (e.g., repair of leak, fine tuning of work), the lockout/tagout procedure must be re-established. Under no circumstances shall work be performed on the equipment without prior isolation of the energy sources.

5.3.2 High Voltage Electrical Systems

In general, AECOM personnel will provide lockout/tagout services in low voltage situations only (voltage is below 600 volts). For high voltage situations (above 600 volts), AECOM will either subcontract operations to an electrical subcontractor or obtain approval of the equipment-specific Lockout/Tagout procedure from the Group SH&E Manager and the Regional Manager. If an electrical subcontractor is utilized, they will be required to provide documentation of their high voltage certification.

5.3.3 Low Voltage Procedure

- Make sure the equipment to be worked on is turned off.
- Locate the source of the electrical supply and isolate the equipment. This can be accomplished by:
  - Turning the appropriate circuit breaker off.
  - Unplugging the equipment.
  - Disconnecting the source from the battery (e.g., pulling cables from automotive batteries).
- Lock the isolation circuit in the closed position using an appropriate locking device and a unique lock and key system.
- Tag the locked-out circuit. The tag used shall warn against the hazard (e.g., Do Not Start), and include a means of identifying the employee who installed the tag and lock.
- Go back to the equipment and try to turn it on to ensure that the proper source has been isolated. If the machine turns on, reverse the above steps (b-d), and start again until the proper circuit is isolated. Report the incident to site safety coordinator as a serious near miss and do not perform the task until proper isolation is performed and verified. The site (project) manager is responsible for developing the written procedure for LOTO of this equipment prior to authorizing re-work on it.
- Complete the LOTO Verification Checklist (Attachment 2)
- Perform the required work.
- Upon completion of the work, inspect the area to ensure all tools and parts are removed. If tools or parts are noticed after the energy source is no longer locked out, steps (a-e) MUST be performed again prior to retrieval of the tools/parts. Under no circumstances shall the items be retrieved without the equipment being locked out.
- Inform anyone in the area that work has been completed and equipment is being energized.
- Remove the tag and lock.
- Turn on the closed circuit following the appropriate procedures (or reconnect the battery cables).
- Turn the equipment on to verify operation.

5.3.4 Pressurized Water or Air/Gas

- Turn the appropriate valve upstream from the area of work to the off position (closed). Note: if steam or water can enter the pipe from the normal downstream side, either verify that the check valve is operating properly, or ensure that all necessary valves have been closed to stop all fluid or steam flow into the section to be worked. 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) must be established on both sides prior to authorizing confined space entry.

- Using the appropriate device, lock the valve(s) in the closed position using a unique lock and key.
- Tag the locked-out valve(s). The tag shall warn against the hazard (Do Not Open) and include date and time of isolation and a means of identifying the employee who installed the lock and tag.
- Allow the system to be worked to cool down (in the case of steam or hot water).
- Relieve the pressure in the system and then drain any fluid 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 bled to atmospheric pressure, the pipes or lines shall be disconnected, blinded, or closed by a valve and locked out and/or tagged accordingly. Observe line entry procedures when first opening the line.
- Complete the LOTO Verification Checklist (Attachment 2)
- Perform the necessary work.
- Ensure all sections are secure and closed.
- Remove the tag and lock.
- Slowly open the valve, stopping when water or steam flow has started. Observe the work performed to make sure no leaks are evident. If there are no leaks, then the valve can be completely opened. If leaks are observed, then re-close the valve, and follow steps 2-5 above to reapply the LOTO to the system.

5.3.5 Natural Gas Lines

- Turn off the valve upstream from the area to be worked.
- Using the appropriate device, lock the valve in the closed position using a unique lock and key.
- Ensure all spark sources in the area have been isolated or removed.
- Using non-sparking tools, 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 must be locked out and tagged out.
- Complete the LOTO Verification Checklist (Attachment 2)
- Perform the required work. If hot work is necessary (i.e. soldering, grinding, welding), make sure the line has been purged of gas and that the hot work requirements of this manual are followed, including explosivity check prior to authorizing work.
- Make sure that all connections are secure. Also, have a solution of soap and water for leak testing.
- Remove all tools and parts from the area.
- Remove the lock(s) and tag(s) from the valve(s).
- Slowly crack open the valve(s).
- Test the work area for leaks using the soap solution. If leaks are detected, the system must be locked out and tagged out following steps 1-4 above before additional repairs can be made.
- If no leaks are detected, gradually open the isolation values to their normal position.

5.4 ANNUAL PROGRAM REVIEW

At least annually (or whenever any incident or serious near miss occurs due to inadequate lockout/tagout) , an independent Authorized Employee who is not involved in the procedure being inspected must conduct and document a review and inspection of the Energy Control Program specific to the identified facility. The inspection should include a meeting with authorized employees and any other affected employees.

The inspection procedure must include the following elements.

- Where lockout is used, discuss the authorized employee's responsibilities under the lockout/tagout program with the inspector.
- Hold group meetings with the authorized employees who are performing the inspection and all authorized employees who implement the procedure.
- Where tagout is used, discuss the authorized employee's responsibilities under the lockout/tagout program and the limitations of the tagout system.
- Review of lockout/tagout verification checklists and other documentation to ensure procedure is being correctly followed and documented.
- If deficiencies are noted during the inspection, corrective actions and retraining of employees, as necessary, must be performed immediately.
- The inspector shall provide a copy of all inspection documentation to the applicable AECOM Manager for review and filing.

These inspections shall at least provide for a demonstration of the procedures and may be implemented through random audits and planned visual observations. These inspections are intended to ensure that the energy control procedures are being properly and consistently implemented.

5.5 TRAINING

5.5.1 Authorized Employees

Authorized Employees involved in or affected by lock out and their Supervisors and Project Managers will be trained in the following areas before being allowed 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;
- Purpose and use of the energy-control (lock out/tag out) procedure, equipment, and devices;
- 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 lock out/tag out procedures.

Authorized Employees are limited to those departmental supervisors and managers, and those selected employees who have successfully completed all of the required training listed above.

5.5.2 Affected Employees

Affected Employees will be trained in the purpose and use of the lock out/tag out procedure. All employees whose work operations may be in an area where lock out/tag out 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.

5.5.3 Retraining

Retraining or refresher training for Authorized 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;
- An inspection reveals deviations from the standard procedures or inadequacies in the employee's knowledge or use of the lock out/tag out procedure;
- An incident occurs as a result of unexpected energy release.

5.5.4 Training Documentation

All employee training, including refresher training, will be documented in accordance with AECOM SH&E SOP 107 Safety Training Programs. 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 Authorized and Affected employees above.

6.0 REFERENCE MATERIAL

29 CFR 1910.147, Control of Hazardous Energy

SH&E SOP 601 – *General Electrical Safety*

7.0 ATTACHMENTS

Attachment 1 – Lock and Tag Removal Form

Attachment 2 – LOTO Verification Checklist

Attachment 3 – Equipment-Specific LOTO Procedure Template

Attachment 4 – Emergency Lock Removal Form

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

AECOM Lock and Tag Removal Form

TAG NUMBER	LOCK NUMBER	LOCATION USED	COMPONENT AFFECTED	DATE/TIME ATTACHED	MANAGER / SUPERVISOR	DATE/TIME RETURNED

LOTO Verification Checklist

EQUIP ID (#) / LOTO LOCATION (S) - DEVICE TYPE & NUMBER:	DATE:
_____	
LOTO REFERENCE NUMBER:	
_____	

LOCKOUT-TAGOUT CHECKLIST	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.)?			
DEACTIVATING ENERGY-ISOLATING DEVICE Have all energy-isolating devices been deactivated so that the machine/equipment is isolated from all energy sources?			
LOCKOUT Has a lock been placed on all appropriate energy isolating devices with an assigned individual lock(s)?			
TAGOUT Has a tag been placed on all appropriate 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 are operationally intact?			
PERSONNEL VERIFICATION Have all personnel been safely positioned or removed from the area and all controls are in neutral?			
LOCKOUT REMOVAL AND EQUIPMENT STARTUP Has all lockout and tagout devices been removed and the machine reenergized?			
EMPLOYEE NOTIFICATION Have all affected been notified that the LOTO is complete and that the machine/equipment is ready for use?			

NOTES:

Equipment-Specific LOTO Procedure Template

PROCEDURE REFERENCE NUMBER:

EQUIPMENT:	
EQUIPMENT NO:	LOCATION:

PURPOSE

This 7-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.

COMPLIANCE WITH THIS PROCEDURE

All employees are required to comply with the restrictions and limitations imposed on them during the use of this procedure. The 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.

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:

Equipment-Specific LOTO Procedure Template

2. The 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

___ Electrical (440V) ___ 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. De-activate the energy isolating device(s) so that the equipment is isolated from the energy sources(s).

Specific Instructions:

Equipment-Specific LOTO Procedure Template

5. 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.

Emergency Lock Removal Form

This form will only be used 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.

1. NAME of personnel who's LO/TO is to be removed:

2. METHOD(s) used to contact personnel who's LO/TO is to be removed:

3. LOCATION of LO/TO:

4. REQUIRED CONTACTS: Contact the following AECOM personnel to locate affected contractor personnel:

Contact Name 1:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 2:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 3:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**
Contact Name 4:			
Office Phone #	**Home Phone #**	**Pager #**	**Cell #**

5. NOTIFICATION:

An AECOM representative has been contacted……... ☐ Yes ☐ No

Notification Verified By:_____(Initial) 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 all personnel are removed from hazardous locations. …… ☐ Yes ☐ No

Notification Verified By: _____(Initial)

Emergency Lock Removal Form

	Print Name	Signature	Date
Project Manager			
SH&E Representative			
AFTER COMPLETION OF THESE STEPS, THE LOCK AND TAG MAY BE REMOVED **This form must be provided to the AECOM Project Management Team (PM and SSO) so the affected employee can be notified that his/her Lock-Out /Tag-Out has been removed**			

AECOM	SH&E No.:	713
	Rev:	Original
Confined Spaces **AECOM Safety, Health and Environmental Procedure**	Date:	October 5, 2009

1.0 PURPOSE

Establishes requirements for AECOM employees to participate in entries into confined spaces.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Asphyxiant – An airborne substance which can cause suffocation. Simple asphyxiants (e.g., carbon dioxide, nitrogen, argon, etc.) physically displace oxygen from the atmosphere while chemical asphyxiants (e.g., carbon monoxide, hydrogen cyanide, etc.) prevent the body from utilizing oxygen in the atmosphere.

Attendant – An individual who is stationed **outside** of a permit-required confined space to monitor the authorized entrants and to initiate emergency response if necessary.

Class 1, Division 1 Approved – Approval given to equipment which has been approved for use in atmospheres which are known to contain flammable gases and vapors.

Confined Space – A space which:

- Is large enough and so configured that an employee can physically enter and perform assigned work;
- Has limited or restricted means for entry or exit; and,
- Is not designed for continuous human occupancy.

Entrant – An employee who is authorized to enter a permit-required confined space.

Entry – The action by which a person passes through an opening into a confined space. Entry is considered to have occurred as soon as any part of the body breaks the opening of a confined space.

Entry Permit – A written or printed document that controls entry into a permit-required confined space.

Entry Supervisor – An employee responsible for determining if acceptable entry conditions are present, for authorizing entry into a permit-required confined space, overseeing entry operations and for terminating entry.

Hazardous Atmosphere – An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following:

- Oxygen concentrations below 19.5%
- Flammable atmospheres (concentrations > 10% of the lower explosive limit)
- Toxic environments (concentrations > than the permissible exposure limit)

Non-Permit Required Confined Spaces (NPRCS) – Spaces that do not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm. These spaces do not require specific entry procedures.

Hot Work – Any task which may produce a spark or source of ignition (e.g., welding, cutting, etc.) in areas potentially containing flammable gases or vapor.

Immediately Dangerous to Life or Health (IDLH) – The exposure limit established by the National Institute for Occupational Safety and Health (NIOSH) which refers to the airborne concentration of a substance which can cause death, serious or irreversible health consequences, or inability to escape within 30 minutes.

Inerting – Displacement of the atmosphere by a nonreactive gas (such as nitrogen) to such an extent that the resulting atmosphere is nonflammable.

Lower Explosive Limit (LEL) – The lowest concentration of a flammable gas/vapor in air which will ignite.

Oxygen Deficiency – An atmosphere with an oxygen concentration less than 19.5%. Normal air contains approximately 21% oxygen. Any atmosphere containing less than 19.5% oxygen shall be considered IDLH (immediately dangerous to life and health).

Permit-Required Confined Space (PRCS) – A confined space that exhibits one or more of the following properties:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

Physical Hazard – A non-chemical hazard which may cause cuts, abrasions, crushing, trauma, hearing loss, burns, or radiant energy effects (e.g., welding).

Upper Explosive Limit (UEL) – The highest concentration of a flammable gas/vapor in air which will ignite.

4.0 ROLES AND RESPONSIBILITIES

4.1 REGIONAL AND DISTRICT OPERATIONS MANAGERS

- Provide Confined Space training to employees engaged in projects covered by this Procedure.
- Assure that Project Managers are implementing confined space entry procedures on their projects where applicable.

4.2 PROJECT MANAGER/FIELD TASK MANAGER

Project/Lead Manager or Resident Engineer on the project is responsible for administering the procedure including:

- Determining alternative procedures that eliminate the need for entering confined spaces
- Consulting with the SH&E regarding project specific requirements for confined space entries
- Informing the field team about the client or facility's requirements for confined space entries
- Ensuring that only trained, authorized employees work in or near confined spaces
- Assuring that each written Confined Space Entry Procedure and permits are prepared for each entry
- Assign an Entry Supervisor to be in control of all activities associated with the confined space
- Assure that air monitoring instruments are rented from an approved vendor or industrial hygiene consultant and calibrated in accordance with the manufacturer’s requirements.

4.3 ENTRY SUPERVISOR

- Assess the risks prior to entry and establish the work plan accordingly
- Notify the SH&E Department prior to entry into a confined space to review the planned activity, circumstances and Confined Space Permit
- Verify what conditions exist

- Verify that all participants (entrants and attendant) are trained
- Conduct a tailgate training session at the location of the confined space reviewing all entries in the Permit with all attendants and entrants.
- Assure that the air within the confined space is tested with an appropriated air monitoring instrument.
- Assure that all air test results are documented on the Permit form.
- Verify that a rescue team, equipped with retrieval equipment and trained in confined space entry rescue is available. A rescue team may be the local Fire Department or a client's Emergency Rescue Squad or the construction project's emergency response team. Emergency rescue capability must be established in the permit process including the emergency contact numbers.
- Notify the emergency rescue service prior to an entry of the time, location and duration of work in a confined space.
- Confirm that appropriate means of communication are assured (in place and operable) for the entry team. Communication can be verbal, hand signals, radio or telephone.
- Confirm that the proper isolation of any process lines, pipes or electrical systems that can affect safety or health of entrants in a confined space are isolated and secure e.g., blanking, blocking, lockout-tagout and verifying that systems are isolated prior to proceeding with work.
- Verify that fresh air ports, manways and accessways are opened during the entire operation.
- Ensure that fresh air is continuously forced into the confined space prior to and during work within a permit required confined space. Exhausting air from a space lends to the risk of drawing contaminated air from elsewhere into the space. The source of fresh air should always be checked. The objective is that the forced air is sufficient to maintain a permit space safe for entry.
- Ensure that appropriate safety equipment is selected and used by all entrants based on the physical and health hazards that may exist.

The entry supervisor may also serve as the outside attendant.

4.4 DUTIES OF THE ATTENDANT

The attendant must remain outside the confined space at all times. The attendant must not leave the post unattended at any time. If the attendant needs to leave his position, entrants must be called out of the confined space or another qualified attendant must take the position and responsibility.

The attendant is responsible for following the Confined Space Permit and shall:

- Confirm that correct names of all entrants are listed on the permit.
- Ensure that all applicable parts of the permit are completed before allowing any AECOM employee to enter the space.
- Ensure that all equipment going into the confined space is in safe operating condition, e.g., tools and protective equipment. It is prohibited for compressed gas bottles (e.g., burning and welding) to be brought into a confined space. All gas lines brought into accessways shall be protected from sharp edges.
- Ensure that all entrants have received any special instructions for the work to be performed before entering into the space.
- Maintain assured and ongoing contact with entrants either visually, verbally, or the use of hand signals or radio.
- Interrupt work and call out any/all entrants in the event of a newly developed dangerous condition, when signs of entrant stress or fatigue are noticed, or when the attendant needs to leave the post and cannot be replaced by another attendant.
- Summon rescue and other services during an emergency.
- Warn any unauthorized persons not to enter a Permit Confined Space.

4.5 ENTRANTS

- Know the emergency action plan and be able to recognize the potential for real hazards associated with the Confined Space. Refer to the Permit and ask the Supervisor or Regional SH&E Manager if a question arises.
- Know how to use the identified personal protective equipment required for entry or rescue.
- In the event of coming upon anyone down and unconscious within a confined space, the first response for anyone including the attendant is to withdraw from the space immediately and send the alert for emergency response. (Most fatalities in confined spaces involve workers who attempt to rescue other workers without the correct equipment and training).
- Know how to exit the confined space as rapidly as possible without help whenever:
    - The attendant orders an evacuation.
    - Any alarm from a continuous monitor/detector sounds.
    - The entrant(s) recognizes the warning signs of exposure to hazardous substances that could be found in that confined space.
- Be aware of the toxic effects or symptoms of the hazardous materials that could be encountered in the confined space.
- Know how to relay an alarm to the outside attendant and to attempt self-rescue immediately upon becoming aware of hazardous conditions.
- Know any modification of normal work practices that are necessary for permit required confined space work.

4.6 ALL EMPLOYEES

- Refrain from making any attempt to enter a confined space without first meeting the requirements of this Procedure
- Avoid areas where other employees are working in confined spaces

5.0 PROCEDURE

5.1 CONFINED SPACES

All confined spaces under the control of AECOM or that may be entered by AECOM employees will be identified, evaluated and classified on a Confined Space Inventory Listing (Attachment 1 or equivalent). The inventory listing shall be updated as required, at a minimum annually. An inventory shall be prepared for each project site containing confined spaces to which AECOM employees are exposed.

5.1.1 Labeling

All permit-required confined spaces under AECOM control will be labeled so that employees are adequately warned of the potential for hazardous conditions. Labeling is not required under the following circumstance:

- The spaces are easily recognizable, numerous, and widely-spaced (e.g., storm sewer manholes). Employees will be instructed that these constitute confined spaces during required training. However, these locations will be included on the inventory.
- A complete inventory has been developed, all personnel have been trained in the use of the inventory, and the workers consult the inventory prior to performance of any work that may require entry into a confined space.

When non-permit-required confined spaces require the implementation of confined space entry procedures because of specific work operations (e.g., painting, welding), all entry points will be labeled or identified by signs to alert all employees of the existence of the hazardous conditions. These labels or signs will be removed only when the hazard no longer exists (e.g., complete curing of the paint).

5.1.2 Classification of Confined Spaces

For each identified confined space, an evaluation to determine the nature and extent of all possible hazards to entrants must be conducted. Consideration will be given to the following types of hazards:

- The presence of possible airborne contaminants at concentrations exceeding established occupational exposure limits (PELs)
- The presence of any physical hazards (e.g., electrical shock, mechanical injury, etc.)
- The presence of flammable or explosive conditions
- The presence of any potential for rapid flooding or engulfment
- Configurations/positioning that may cause an entrant to become trapped
- Initial classification as either a PRCS or NPRCS

The evaluation will be documented using the Confined Space Hazard Assessment form found in Attachment 2. A copy of this evaluation will be maintained in the project files.

Wherever the confined space is controlled by a client or third-party, the controlling entity should be contacted to provide the information necessary to complete the evaluation. However, if AECOM personnel are required to enter a confined space owned or controlled by others, the final evaluation will remain the responsibility of responsible AECOM manager.

Non-permit-required confined spaces can be designated only by a Certified Industrial Hygienist, Certified Safety Professional, AECOM Regional SH&E Manager or Professional Engineer after review of the space(s), historical monitoring data, and other factors (e.g., injuries that have occurred). Therefore, all confined spaces will be considered permit-required unless specifically designated as a non-permit space, in writing, on the approved confined space inventory listing.

5.2 PRCS-SPECIFIC ENTRY PROCEDURES

To protect employees during PRCS entries, and to meet the requirements of 29 CFR 1910.146, AECOM-specific PRCS entry procedures will be developed for each PRCS to be entered. Each entry procedure will detail:

- The identity of the PRCS(s) to which the procedure applies;
- Details concerning the potential hazards associated with the entry operation/PRCS;
- Pre-entry preparation:
- Required air monitoring equipment;
- Required emergency response/extraction equipment;
- Required ventilation procedures (as applicable);
- Required isolation procedures (as applicable);
- Rescue agency notification requirements (as applicable);
- Required pre-entry monitoring procedures and applicable at-entry re-classification criteria
- Air monitoring procedures during entry (if re-classification has not occurred);
- PPE requirements during entry.

Specific entry procedures can be documented by following the procedures in sections 5.3 through 5.6 of this procedure and by completing a Job Safety Analysis in combination with a completed Confined Space Hazard Analysis and Confined Space Permit.

5.3 PRCS PRE-ENTRY PROCEDURE:

Prior to the start of the entry operation, the Entry Supervisor will assign individuals on the entry team to the following jobs:

- Entrant – The person entering the PRCS
- Primary Attendant - The person dedicated only to assisting the entrant, observing the entry operation and maintaining communications with the entrant throughout the entry procedure.
- Secondary Attendant for Rescue Procedures – An additional employee may be assigned either to specific support of the entry operation or working nearby who can assist with rescue operations in the event of an accident. This person can perform other duties unrelated to observing the entry.

The Entry Supervisor is responsible for ensuring that the individuals assigned to each job fully understand their duties and responsibilities prior to initiating the entry operation. The Entry Supervisor will review the complete entry procedure with all team members prior to the work. The Entry Supervisor will also verify the availability of rescue services.

Additional requirements for Pre-Entry Planning include the following:

- Select the appropriate equipment to measure the potential hazards. Select a multi-gas meter capable of measuring oxygen, combustible gas (%LEL), and other Hazardous Gases.
- Determine the acceptable values for the hazardous conditions being measured, based on the equipment in use and the field calibration method. The action levels are determined as follows:

  Oxygen - 19.5% - 23.5%

  Lower explosion limit - 10%

  Hydrogen sulfide - 5 ppm

  Carbon monoxide - 15 ppm

  Other toxic chemicals - Contact Health and Safety Department

  Ensure all the equipment selected is calibrated, and calibration is still valid.

Personnel trained in accordance with this procedure shall perform field verification of equipment as follows:

- Calibrate combustible gas meters using appropriate span gas for the detectors to be used. (This span gas calibration shall be performed each time the instrument is turned on).
- Check detector tube pumps for leakage using the manufacturer's procedures.
- Calibrate Photo ionization detectors (PID) using isobutylene, or other material, in accordance with the manufacturer's directions.
- Calibrate any other instrumentation to be used in accordance with manufacturer's directions.
- Set up barricades around the space being entered as required.
- Set up required rescue or retrieval systems.
- Institute required lockout/tagout procedures (i.e. electrical, steam, liquid flow-pipe blanking)
- Ensure that a second person (trained as entry attendant) is available and assists in the set up procedures.
- Agree upon a means of communication between the entrant and the attendant. (The attendant is not authorized to perform rescue involving entry into the space, unless he/she is trained for rescue and another entry attendant replaces him/her prior to the attempt to rescue).
- Verify a means to contact emergency rescue services for further assistance.
- Complete Confined Space Entry Permit.

The Entry Supervisor shall also:

- Have the attendant verify the completion of the required actions.
- Entry supervisor shall sign the Permit upon verification of completed actions.
- Maintain the Permit at all authorized entry sites until completion of the entry.

5.4 PRCS ENTRY PERMITS

A PRCS Entry Permit is required to be completed for each individual PRCS entry operation (Exception: Multiple entries of an individual PRCS during a single work shift can be covered by a single Permit). The Permit provides the means for documenting:

- The identities and roles of all individuals involved in the entry operation.
- Equipment used for performance of the entry (monitoring instruments, extraction equipment, etc.).
- Pre-entry and operational monitoring results.
- Communications protocols between Entrants, Attendants, and rescue services.
- Lockout/Tagout procedures
- PPE for specific tasks (refer to the JSA for the task)
- Other relevant workplace conditions or events related to the entry operation (e.g., vault isolation procedures).

The Permit also provides the documented basis for re-classification of any PRCS as non-permit required (for purposes of the particular entry operation) based upon pre-entry monitoring procedures. Each Permit will be signed and authorized by the Entry Supervisor. At the completion of the entry operation, the Permit will be filed as part of the project records.

A copy of AECOM's PRCS Entry Permit form is provided in Attachment 3 and an example of AECOM's Confined Space Entry Classification Guidance is provided in Attachment 4.

5.5 PRCS ENTRY PROCEDURE

- Check the area around the seal to ensure that no flammable situations exist prior to door or cover removal. Note: Always check for oxygen levels first if the meter does not measure simultaneously. Low oxygen levels can cause LEL readings to be incorrect.
- Don any required PPE.
- Carefully remove any access doors or covers.
- Upon removal of the access cover/door, check the immediate atmosphere using remote testing procedures to ensure the immediate atmosphere is safe. If any of the parameters being tested are outside the action level, do not enter.
- If necessary, use exhaust ventilation to either remove the contaminant(s) or to correct the oxygen-deficient atmosphere.
- If the initial test(s) are within allowable ranges, slowly enter the space, continually testing the atmosphere in front and to the sides.
- In stratified atmospheres (i.e., vertical entries), testing will be done 4 feet in advance of the direction of travel. Travel speed will allow for adequate instrument response time.
- The entire area where work is to be performed will be tested prior to performance of any work.
- While performing the work, place the direct read instruments in a location that will not interfere with the work, allow for continual monitoring, and allow for noting any alarms that may be activated.
- Upon work completion, pick up all equipment and leave the space.

5.6 PRCS EXIT PROCEDURE

- Replace all access covers.
- Ensure all signs are visible and legible.
- Remove all lockout/tagout equipment.
- Note on the Permit any problems encountered while in the space.

- Finish the Permit and turn it in to the Entrant Supervisor.
- The Entrant Supervisor will inspect the Permit for completion and investigate any noted problems. Actions taken to correct noted problems will be discussed with all authorized entrants and attendants for future implementation.
- The completed Permit will be maintained on file as required in this section.

5.7 NON-PERMIT REQUIRED CONFINED SPACE ENTRY PROCEDURE

Persons entering this type of space only need to complete a confined space entry permit and remain vigilant about conditions in the space and remember that if any condition changes or if hazards are introduced into the space (e.g. welding/cutting operations), the classification and entry procedures in the space may change.

5.7.1 NPCS Entry Procedure

- When entrance covers are removed, guard the opening to prevent an accidental fall through the opening and to protect each employee working in the space from foreign objects entering the space.
- Check the atmosphere with the gas detector for Oxygen, LEL and other Hazardous gases (e.g. CH4, H2S, and CO) in the same order prior to entry into the space.
- Record the measured conditions on the permit and do not allow entry if detected levels are above action levels.
- Proceed with entry and work with caution.

5.7.2 NPCS Post Entry Procedures

The following post-entry procedures must be followed after the completion of a non-permit required confined space entry:

- Replace all access covers.
- Ensure all signs are visible and legible.
- Remove all lockout/tagout equipment, if applicable
- Note any problems encountered while in the space on the Permit.
- Finish the Permit, and turn in to the entrant supervisor.
- The entrant supervisor shall inspect the Permit for completion, and investigate any noted problems. Actions taken to correct noted problems shall be discussed with all authorized entrants and attendants for future implementation.
- The completed Permit shall be maintained in record for annual review.

5.8 ALTERNATE ENTRY PROCEDURES

Under certain conditions, alternative entry procedures may be used. The SH&E Department representative may prescribe alternate procedures if justified.

5.9 RESCUE SERVICES

5.9.1 Outside Rescue Service (including client services)

- Prior to authorizing entry into any confined space, Project Manager should:
- Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner (within 3 minutes for life threatening situations or 15 minutes for non-life threatening injuries), considering the hazard(s) identified;
- Evaluate a prospective rescue service's ability.
- Select a rescue team or service from those evaluated that:

- Has the capability to reach the victim(s) within a timeframe that is appropriate for the permit space hazard(s) identified [as defined in 4.4 (1) above];
- Is equipped for and proficient in performing the needed rescue services;
- Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site; and
- Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

5.9.2 AECOM Rescue Service

Prior to authorizing entry into any confined space, Project Manager should:

- Provide affected employees the required personal protective equipment (PPE) and train them in its use;
- Train affected employees to perform assigned rescue duties;
- Train affected employees in basic first-aid and cardiopulmonary resuscitation (CPR) (at least one member shall hold a current certification in first aid and CPR); and
- Ensure that affected employees practice making permit space rescues at least once every 12 months.

5.9.3 Facilitating Non-Entry Rescue

- Retrieval systems or methods shall be used whenever an authorized entrant enters a permit space (unless the retrieval equipment would increase the overall risk of entry).
- Retrieval systems shall meet the following requirements:
  - Each authorized entrant shall use a chest or full body harness with a retrieval line attached at the center of the entrant's back near shoulder level or other suitable locations as appropriate.
  - The other end of the retrieval line shall be attached to a mechanical device (mandatory for more than 5 feet deep rescue) or fixed point outside the permit space.

6.0 REFERENCE MATERIAL

29 CFR 1910.146 – *Permit Required Confined Spaces*

29 CFR 1910.147 – *Control of Hazardous Energy (Lockout-Tagout)*

7.0 ATTACHMENTS

Attachment 1 – Confined Space Identification Log

Attachment 2 – Confined Space Hazard Assessment Form

Attachment 3 – Confined Space Entry Permit Form

Attachment 4 – Confined Space Entry Classification Guidance

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

ATTACHMENT 1: CONFINED SPACE IDENTIFICATION LOG

Name of Space and Location	Permit Required Confined Space		Alternate Procedure Confined Space		Non-Permit Required Confined Space	
	Y	Initial Date Inventoried	Y	Date Reclassified	Y	Date Reclassified

Attachment 2: Confined Space Hazard Assessment Form

AECOM

PART 1. CONFINED SPACE IDENTIFICATION
Confined Space Name:
Dimensions:
Description of Space:
Is this space entered on a routine basis? ☐ Yes ☐ No
Described Tasks and Frequency:

PART II. NATURE OF THE HAZARDS – ASSUMPTIONS: Tanks are empty and clean, all energy sources identified and isolated, and no other hazards are introduced into the spaces. A more formal hazard assessment must be done at time of entry.

Potential Atmospheric Hazards	**Potential Non-Atmospheric Hazards**
☐ O_2 Deficient /Enriched	☐ Contains Material Which Could Engulf Entrant?_____
☐ Combustibles/Flammables	☐ Internal Config. Could Trap Entrant?_____
☐ CO	☐ Electrical (live circuits)? _____
☐ H_2S	☐ Mechanical (pipes, linkages)?_____
☐ Other Toxics	☐ Slick/Residue Covered Surfaces?_____
	☐ Equipment Preventing Safe Exit?_____
	☐ Low/Inadequate Lighting?_____
	☐ Hazardous Chemicals Present? _____
	☐ Fall Potential?_____
	☐ Potential for Dropped Objects?_____
	☐ Multiple Work Groups/Nature of Work_____
	☐ Other _____

Photo of Space Here...

Attachment 3: PRCS Entry Permit Form

1. Permit space to be entered:_____ Project Name & No.:_____
2. Purpose of entry:_____
3. Good on this date only:_____ From:_____AM/PM To:_____AM/PM

Authorized Entrants:	Authorized Attendants:	Entry Supervisor:
_____	_____	_____
_____	_____	_____
_____	_____	_____

5. Hazards within the permit space:_____

_____

_____

6. Permit Space Preparation

1. Work area isolated with signs/barriers? _____Yes_____No
2. All energy sources locked/tagged out? _____Yes_____No
3. All input lines capped/blinded? _____Yes_____No
4. Permit Space contents drained/flushed/neutralized? _____Yes_____No
5. Permit Space cleaned/purged? _____Yes_____No
6. Ventilation provided 30 minutes before entry? _____Yes_____No

7. Initial atmospheric testing

	Reading	Time	Acceptable level
Oxygen %	_____	_____	_____
LEL	_____	_____	_____
Other Contaminants	_____	_____	_____
Other Contaminants	_____	_____	_____
Other Contaminants	_____	_____	_____

8.

Test (s) To Be Taken	Permissible Entry Levels	Test 1	Test 2	Test 3	Test 4
A. Percent Oxygen	19.5% to 23.5%				
B. Explosivity	<10% LEL				
C.					
D.					
E.					
Name of Tester					
Test Times					

Attachment 3: PRCS Entry Permit Form

9. Rescue Services (circle one) On Site Off Site

Phone # for Rescue Services or means of summoning:

_____

_____

10. Communication devices and procedures to be used during entry:

_____

_____

11. Safety Equipment required for entry:

PPE N/A ( ) YES ( ) Specify_____

Testing Equipment N/A ( ) YES ( ) Specify_____

Alarm System N/A ( ) YES ( ) Specify_____

Rescue Equipment N/A ( ) YES ( ) Specify_____

Other N/A ( ) YES ( ) Specify_____

12. Additional Permits Required:

Hot work: ☐ Yes ☐ No

Other: ☐ Yes ☐ No

13. Permit Authorization:

I certify that I have inspected the work area for safety and reviewed all safety precautions recorded on this permit.

Permit Authorization by entry Supervisor (Signature): _____ Date/Time_____

14. Permit Conditions Verification:

Physical conditions at confined space checked and verified to be in accordance with the permit ☐ Yes ☐ No

If no; please record the deviation observed and corrective action taken:

_____

_____

_____

Verified by : _____ _____ _____

(Entry Supervisor) Date Time

Attachment 3: PRCS Entry Permit Form

15. Review & Close-out:

Please list problems encountered during entry:

_____
_____
_____

Corrective / Preventive Action Taken:

_____
_____
_____

Additional Precautions / Recommendation for Future Entry:

_____
_____
_____

Based on this review, this confined space shall be considered:

- Permit Required Confined Space ☐ Yes ☐ No
- Non-Permit Required Confined Space ☐ Yes ☐ No
- Alternate Procedure Confined Space ☐ Yes ☐ No

Reviewed By:_____ _____ _____

(Entry Supervisor) Date Time

ATTACHMENT 4

Confined Space Entry Classification Guidance											
Facility Name Here											
						METER READINGS					
Confined Space Name	Confined Space Location	Task Description	Permit required confined space	Enter By Alternate Procedure	Enter Following Non Permit Procedure	O2	LEL	H2S	CO	Entry rescue	Non entry rescue

AECOM	SH&E No.:	714
	Rev:	Original
Excavation and Trenching **AECOM Safety, Health and Environmental Procedure**	Date:	October 5, 2009

1.0 PURPOSE

To evaluate all excavation operations to provide for proper protective systems for employee protection from associated hazards.

2.0 SCOPE

This SOP applies to all AECOM U.S.-based employees and operations..

3.0 DEFINITIONS

Benching (Benching system) – A series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels to protect employee from cave-ins.

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.

Competent person – Person, who, by way of training or experience, is capable of classifying soils and is also capable of identifying existing and predictable hazards an excavation/trenching work area and who has the authority to take prompt corrective measures to eliminate them.

Excavation – A man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

Faces (or sides) – The vertical or inclined earth surfaces formed as a result of excavation work.

Failure – A structural member's integrity and supportive capabilities is compromised, causing a breakage, displacement or permanent deformation.

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.

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.

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.

Registered Professional Engineer – An engineer who is can authorize any state of work by his professional designation. However, a professional engineer registered in any state 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.

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."

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.

Sloping (Sloping system) – A method to protect employees from cave-ins by excavating the sides of an excavation to a rise run ratio. 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.

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 registered professional engineer.

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.

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 not greater than 15 feet (4.6 m). 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 (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered a trench.

4.0 ROLES AND RESPONSIBILITIES

4.1 PROJECT MANAGERS

All projects under their direct control or authority and involve excavations or trenching, are conducted in a safe and efficient manner and in accordance with the requirements of this SOP.

All projects under their direct control or authority have a written HASP prepared for the activity.

4.2 COMPETENT PERSON

Where entry by AECOM employees into trenches or excavations greater than 5 feet (4 feet for work in CA, WA or for certain clients) in depth is planned, a competent person shall be present at all times. 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 Attachment 2 of this SOP prior to determining that a maximum allowable slope, other than 34° 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.

4.3 EMPLOYEES

They will not enter trenches or excavations greater than 5 feet (or as above) in depth unless the requirements in this SOP have been met.

5.0 PROCEDURE

5.1 UNDERGROUND AND OVERHEAD UTILITY AVOIDANCE

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.

5.2 HEAVY EQUIPMENT OPERATION

- Only experienced, demonstrably proficient, equipment operators will be used to operate such heavy equipment as backhoes, front-end loaders, cranes, etc. Where certification or licensing requirements exist, such personnel shall possess appropriate certification and/or licensing for operating specified heavy equipment.

- While operating heavy equipment in the work area, the equipment operator shall maintain communication with a designated signalman through either direct voice contact or approved standard hand signals. In addition, all site personnel should maintain a safe distance and remain clear of the swing of operating excavation equipment.
- All site personnel that operate or work in the vicinity of heavy equipment shall wear all AECOM required safety equipment.
- 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.
- 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.

5.3 WORK IN TRENCHES AND EXCAVATIONS

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 Regional SH&E Manager.

5.4 SYSTEMS TO PROTECT PERSONNEL FROM CAVE-INS

Each employee 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 5 feet (and as above) in depth and an examination of the excavation by a competent person reveals no indication of a potential cave-in.
- The depth of the excavation is to be measured at its greatest vertical dimension. Be aware that crouching or kneeling in a trench which is greater than three feet in depth may still pose significant hazard for the employee involved.
- The protective system may include sloping the excavation walls, shoring the excavation walls or installing a shielding system. The protective system chosen must have the capacity to resist, without failure, all loads to be applied to the system.
- Any excavation deeper than 20 feet; a Professional Engineer must approve and sign on all protective systems.

5.5 USE OF SLOPING AS A MEANS OF PROTECTION

Sloping the walls of the trench or excavation is the preferred, and typically simplest, means of protecting employees who must enter trenches or excavations which are greater than 5 feet in depth (and as above) or where there is danger of collapse.

The trench or excavation walls may be sloped back so that the ratio of the horizontal distance to the vertical rise (H:V ratio) of the sloped wall is at least 1½:1 (i.e., equivalent to an angle with the horizontal of 34° or less) or,

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° (or less) with the horizontal typically be selected.

5.6 USE OF SHORING OR SHIELDING AS A MEANS OF PROTECTION

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.

5.7 HEALTH AND SAFETY PLAN

All activities which will involve entry by AECOM personnel into excavations or trenches greater than 5 feet (and as above) in depth, will require that a written HASP be developed prior to the start of work and implemented once work begins.

This HASP must be developed by the Project Manager and approved by the Regional SH&E Manager before it is implemented in the field.

5.8 COMPETENT PERSON

A competent person must be present during all work which involves entry by AECOM personnel into trenches or excavations greater than 5 feet in depth (as above). An AECOM competent person must be qualified per SH&E SOP 721, Competent Person Designation.

For the purpose of this SOP, a competent person is defined as an individual, who by education or experience, is capable of evaluating the hazards associated with trench or excavation collapse and is capable of classifying soils. The competent person for the project will be indicated in the Health and Safety Plan written for the project.

5.9 ACCESS AND EGRESS

A stairway, ladder, ramp, or other safe means of egress shall be located in excavations or trenches that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

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.

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.

5.10 PROTECTION OF EMPLOYEES FROM LOOSE ROCK OR SOIL

Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection such as sloping or benching.

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (0.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

5.11 PROTECTION FROM HAZARDS ASSOCIATED WITH WATER ACCUMULATION

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 lifeline.

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 ensure proper operation.

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 an inspection by a competent person.

5.12 HAZARDOUS ATMOSPHERES

To prevent exposure to harmful levels of atmospheric contaminants, entry into trenches and excavations greater than 5 feet in depth (as above) in which a hazardous atmosphere exists, or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, entry must be performed in accordance with the requirements specified in AECOM SH&E SOP 713 – *Confined Spaces Operations*.

Adequate precautions, such as mechanical ventilation, shall be taken prior to entry into trenches and excavations in which the oxygen concentration is less than 19.5 percent or the concentration of flammable gases or vapors is in excess of 10 percent of the lower explosive limit (LEL).

When controls are used that is intended to reduce the level of atmospheric contaminants to acceptable levels, testing shall be conducted as often as necessary to ensure that the atmosphere remains safe.

Appropriate respiratory protection must 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 (TLV) or Permissible Exposure Limit (PEL).

5.13 EMERGENCY RESCUE EQUIPMENT

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, shall be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation and entry into the excavation is expected. This equipment shall be attended when in use.

5.14 SPECIAL EXCAVATION ENTRY PERMIT REQUIRED FOR CALIFORNIA

In California, for the construction of trenches or excavations that are 5 feet or deeper and into which a person is required to descend, an additional permit must be obtained from Cal/OSHA. Additional information on this requirement can be found at Cal/OSHA's web site at the following address:

http://www.dir.ca.gov/DOSHPol/P&PC-41.htm

5.15 STABILITY OF ADJACENT STRUCTURES

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 ensure the stability of such structures for the protection of employees.

Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

- A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or
- A registered 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 registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

In addition, sidewalks, pavements, and appurtenant 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.

5.16 EXPOSURE TO VEHICULAR TRAFFIC

Employees exposed to public vehicular traffic shall be provided with, and shall wear safety vests or other suitable garments marked with or made of reflective or high-visibility material. Traffic cones or other suitable warning devices shall be used to identify the boundaries of the work area. If necessary, a trained flag person shall be utilized to guide vehicular traffic around the work area.

5.17 EXPOSURE TO FALLING LOADS

No employee shall be permitted underneath loads handled by lifting or digging equipment. 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.

5.18 HAZARDS OF OPEN EXCAVATIONS

5.18.1 Warning Systems for Mobile Equipment

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 shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

5.18.2 Inspections

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. 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.

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 ensure their safety.

5.18.3 Fall Protection

Where employees or equipment are required or permitted to cross over excavations, walkways or bridges walkways or bridges over excavations must have a minimum clear width of 20”, be fitted with standard guard rails and extend a minimum of 24” past the surface edge of the trench. If vehicle crossings over excavations are required, they must be designed by and installed under the direction of a registered professional engineer.

Adequate barriers or other forms of physical protection shall be provided to prevent unauthorized access for all excavations that are left open overnight. All wells, pits, shafts, etc., shall be barricaded or covered. Upon completion of exploration and similar operations, temporary wells, pits, shafts, etc., shall be immediately backfilled

6.0 REFERENCE MATERIAL

SH&E SOP 605 – *Fall Protection*

SH&E SOP 710 – *Heavy Equipment Operations*

SH&E SOP 713 – *Confined Spaces*

SH&E SOP 718 – *Marine Operations/Working On or Near Water*

SH&E SOP 721 – *Competent Person Designation*

SH&E SOP 726 – *Identifying Underground Utilities*

7.0 ATTACHMENTS

Attachment 1 – Selection of Protective Systems for Excavation 20 feet or Less in Depth

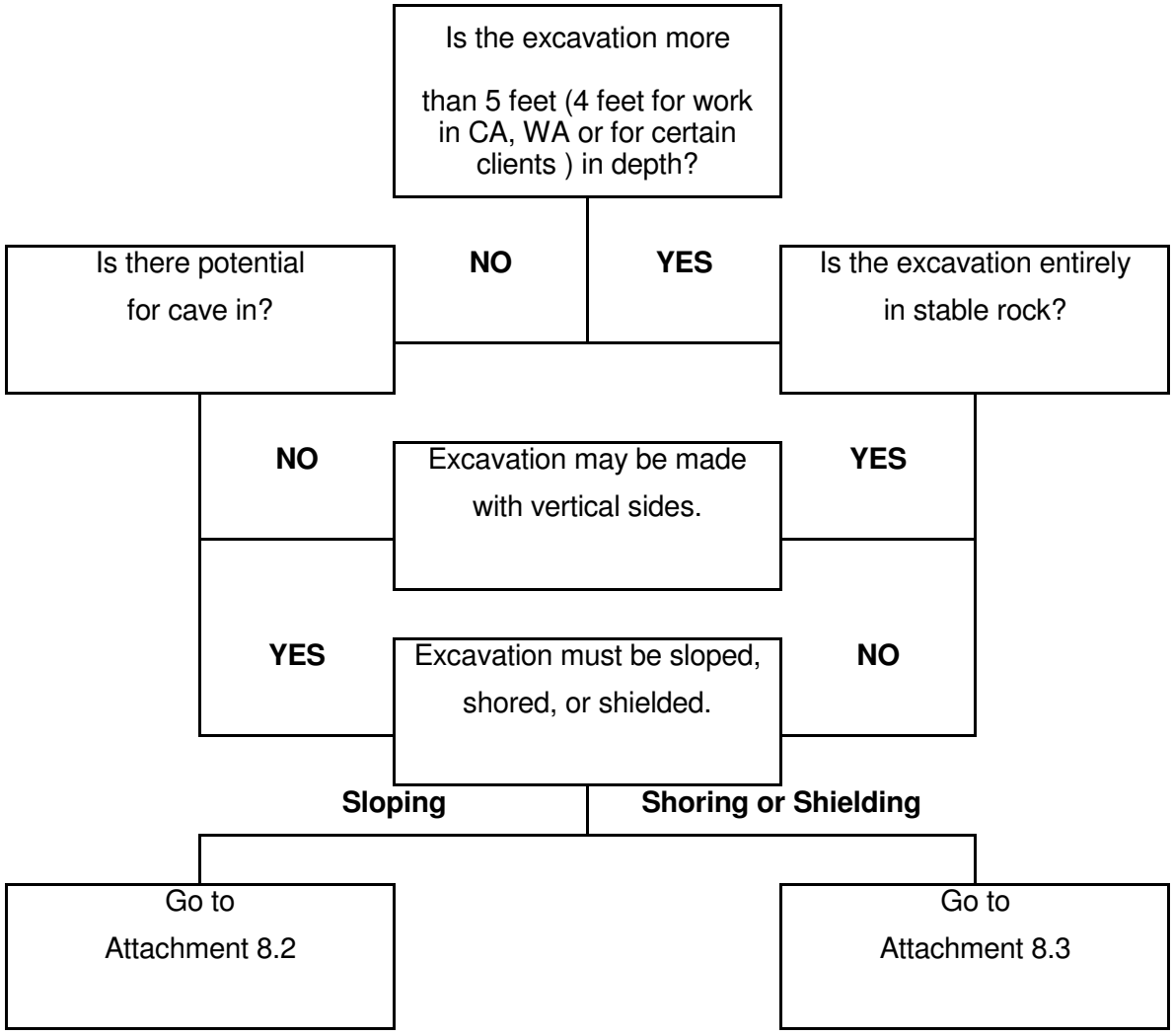
Attachment 2 – Sloping Options

Attachment 3 – Shoring or Shielding Options

8.0 REVISION HISTORY

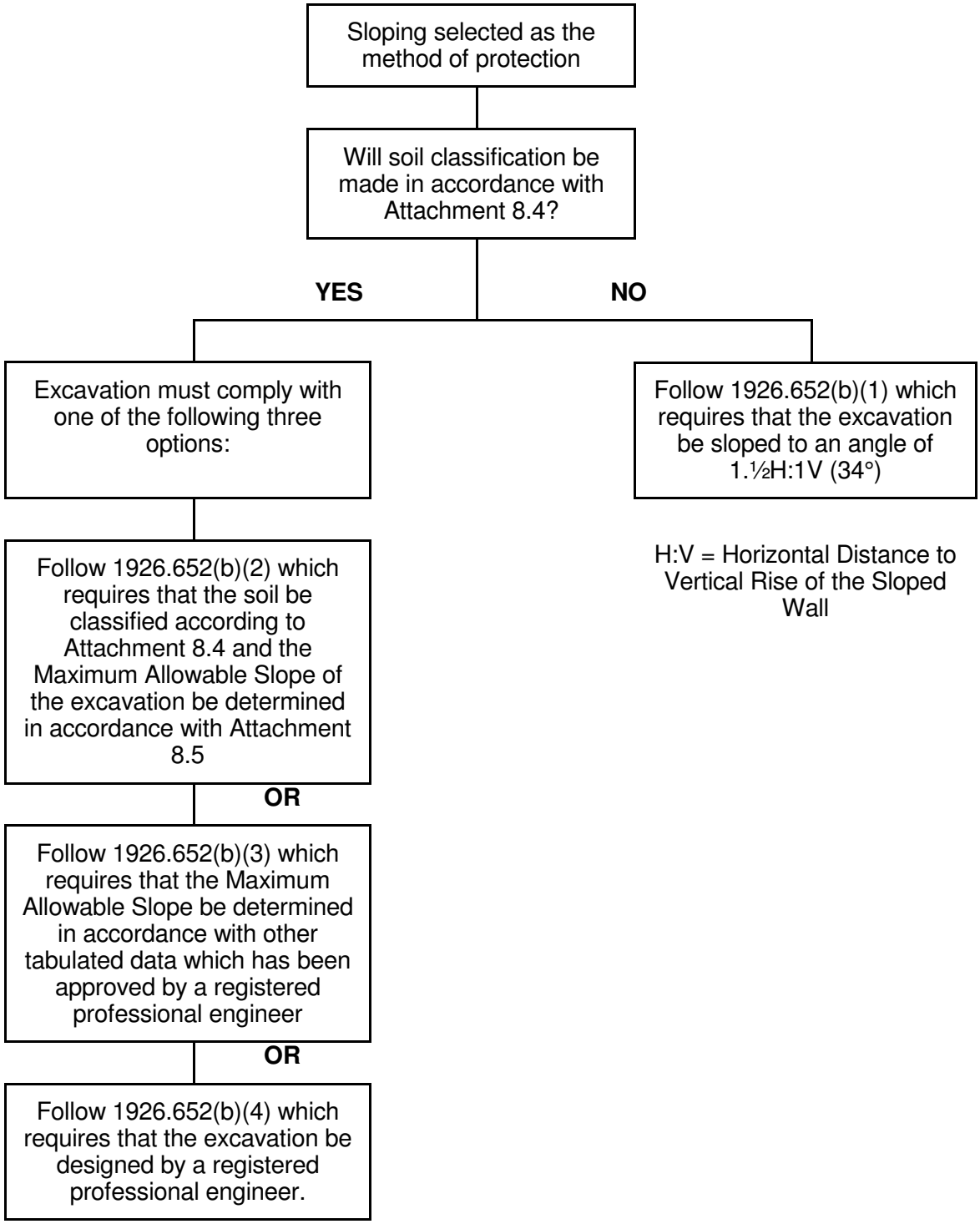
Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

Attachment 1: Selection of Protective Systems for Excavations 20 Feet or Less[1] in Depth

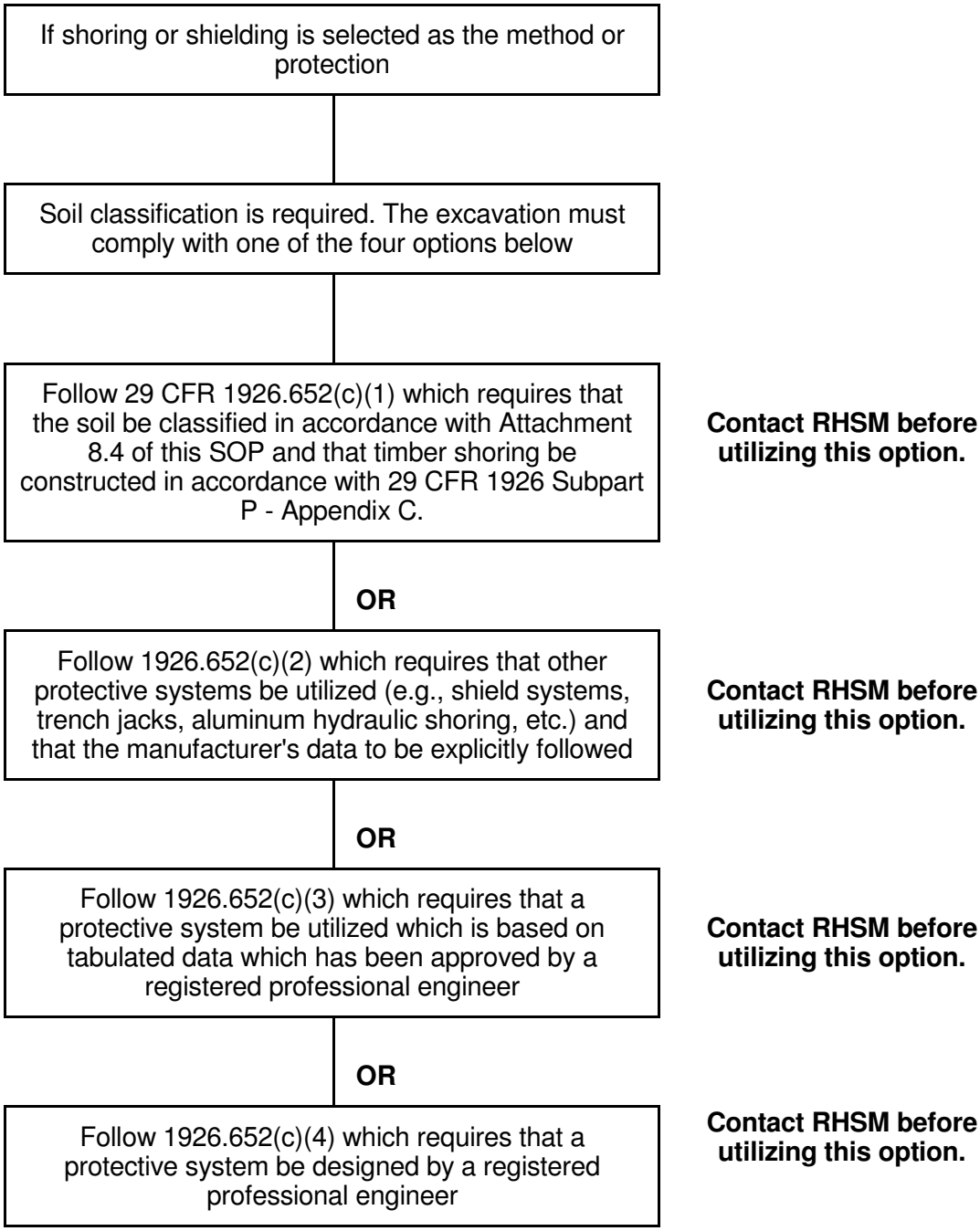


[1] Protective systems for excavations greater than 20 feet in depth must be designed by a registered professional engineer in accordance with 1926.652 (b) and (c).

Attachment 2: Sloping Options



Attachment 3: Shoring or Shielding Options



AECOM Identifying Underground Installations **AECOM Safety, Health and Environmental Procedure**	SH&E No.:	726
	Rev:	Original
	Date:	October 5, 2009

1.0 PURPOSE

Establishes the requirements so that underground installations are identified properly before excavation work commences.

2.0 SCOPE

This procedure applies to all AECOM U.S.-based employees and operations.

3.0 DEFINITIONS

Underground Utilities – All utility systems located beneath grade level including gas, electrical, water, compressed air, sewage, signaling and communications, etc.

4.0 ROLES AND RESPONSIBILITIES

- **Project Manager** – Responsible to see that all work is planned and performed in accordance with contract specifications and safety requirements including the identification, location and access to all underground utilities.
    - The planning for associated work and avoidance of contacting underground utilities shall be part of the project safety planning in the HASP.
- **Lead Site Manager or Supervisor** – Responsible for the execution of work in accordance with this and other associated AECOM SOPs, including:
    - The review of the HASP
- **Regional SH&E Manager** – Provides guidance as needed.

5.0 PROCEDURE

5.1 GENERAL

Serious injuries and significant property damage have resulted from insufficient/inadequate identification of underground installations during the course of excavation work. To control hazards associated with coming in contact with such installations, the American Public Works Association's (APWA) guidelines for the uniform identification of underground installations has been adopted.

5.2 IDENTIFICATION OF INSTALLATIONS

Various forms of underground utility lines or pipes may be encountered during AECOM deployments to field sites. Damaged utilities in particular, can present other hazards including asbestos, explosion, electric shock, scalding, etc., and they must be avoided. The presence of damaged utilities at any work location shall be immediately brought to the attention of the field Lead Manager or other member of the AECOM site management team.

Guidance will be provided on the appropriate action to be taken which could include suspension of work until the responsible utility agency is contacted and the hazard is either isolated or eliminated.

Extreme caution shall always be exercised when attempting to locate underground utilities. The location of utilities can be in some cases not consistent with that shown on drawings, placement of surface signage or described by personnel. Coordination and planning of the job shall be required with the client or owner.

- Prior to digging and drilling operations, the client shall always be contacted as to the potential location(s) of underground utility systems.
- If a utility permit is required from the client or owner, it shall be secured.
- The client shall explain how the utility line may be identified e.g., red concrete encasement.
- All underground installations shall be considered "live" and "operational" until the owner, client or utility authority isolates any hazardous energy or deactivates the system and can demonstrate that condition.
- Where a line placement and depth is known or suspected and where there is potential for contact, hand digging or hand auguring, instrumentation and other investigative techniques shall be used.
- The One Call System Definition and Directory (Attachment 1) or its equivalent shall be used to prepare for excavation work in the event the identity of an underground installation(s) is unknown. Quick reference to utility locator numbers can also be found on the Internet at: http://www.mail-house.com/utility.htm.

Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines contained in this SOP or as contract-specified.

5.3 SURFACE MARKINGS

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.

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 two inches.

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 must clearly indicate that the actual installation is a specific distance away.

5.4 UNIFORM COLOR-CODING

The colors and corresponding installation type are as follows unless otherwise contract-specified.

Red – Electric Power Lines, Cables, Conduit and Lighting Cables

Yellow – Gas, Oil, Stream, Petroleum or Gaseous Materials

Orange – Communication, Alarm or Signal Lines, Cables or Conduit

Green – Sewers and Drain Lines

White – Proposed Excavation

5.5 RECORDKEEPING

The following records will be maintained in the project files regarding identification and response to underground utilities:

- All information regarding the identification of underground installations (this information can also be transferred to the appropriate drawings and/or prints and shall be available on site)
- Drawings and/or prints shall be maintained for the life of this project
- Identifying Underground Installations Checklist

6.0 REFERENCE MATERIAL

SH&E SOP 708 – Pile Driving

SH&E SOP 714 – *Excavation and Trenching*

SH&E SOP 716 – *Drilling and Boring*

American Public Works Association, Excavator's Damage Prevention Guide and One-Call System Directory International 1990-1991, Utility Location and Coordination Committee

7.0 ATTACHMENTS

Attachment 1 – One Call System Definition and Directory

Attachment 2 – Identifying Underground Installations Checklist

8.0 REVISION HISTORY

Revision	Date	Change
Original	October 5, 2009	N/A
Revision 1		

One Call System Definition and Directory

What Is It?

It is a communication system established by two or more utilities, governmental agencies, or other operators of underground facilities 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.

Why Is It Needed?

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 were vulnerable to excavating machines such as backhoes and the resulting damage interrupted utility service and threatened life, health, and property.

How to Get It

Write or call the number of the Utility Location and Coordination Council (ULCC) One-Call Systems International Committee representing the area within your American Public Works Association (APWA) region shown on the map. They will be pleased to assist you. For further information on ULCC programs, write APWA headquarters.

Disclaimer

The purpose of this Directory is to illustrate the extent of one-call service available. The accuracy of information is not guaranteed by APWA or the one-call systems. Users must verify information including the extent and limit of service from local sources.

State	One-Call Agency	Number
Alabama	Alabama Line Location Center, Inc.	1-800-292-8525
Alaska	Locate Call Center of Alaska, Inc.	1-800-478-3121
Arizona	Arizona Blue Stake, Inc.	1-800-STAKE-IT (1-800-782-5348)
Arkansas	Arkansas One Call System, Inc.	1-800-482-8998
California	Underground Service Alert North	1-800-227-2600
Colorado	Utility Notification Center of Colorado	1-800-922-1987
Connecticut	Call Before You Dig	1-800-922-4455
Delaware	Miss Utility of Delmarva	1-800-282-8555
Florida	Call Sunshine	1-800-432-4770
Georgia	Utilities Protection Center, Inc.	1-800-282-7411
Idaho	Dig Line	1-800-342-1585
	Kootenai County Utility Coordinating Council	1-800-428-4950
	One Call Concepts – Idaho	1-800-626-4950
	Palouse Empire Underground Coordinating Council	1-800-822-1974

State	One-Call Agency	Number
	Shoshone County One Call	1-800-398-3285
	Utilities Underground Location Center	1-800-424-5555
Illinois	Digger (Chicago Utility Alert Network)	312-744-7000
	Julie, Inc.	1-800-892-0123
Indiana	Indiana Underground Plant Protection Services, Inc.	1-800-382-5544
Iowa	Underground Plant Location Service, Inc.	1-800-292-8989
Kansas	Kansas One-Call Center	1-800-DIG-SAEE
Kentucky	Kentucky Underground Protection Inc.	1-800-752-6007
Louisiana	Louisiana One Call System, Inc.	1-800-272-3020
Maine	Dig Safe - Maine	1-800-225-4977
Maryland	Miss Utility	1-800-257-7777
	Miss Utility of Delmarva	1-800-282-8555
Massachusetts	Dig Safe - Massachusetts	1-800-322-4844
Michigan	Miss Dig System, Inc.	1-800-482-7171
Minnesota	Gopher State One Call	1-800-252-1166
Mississippi	Mississippi One-Call System, Inc.	1-800-227-6477
Missouri	Missouri One Call System, Inc.	1-800-344-7483
Montana	Utilities Underground Location Center	1-800-424-5555
Nebraska	Diggers Hotline	1-800-331-5666
Nevada	Underground Service Alert North	1-800-227-2600
New Hampshire	Dig Safe - New Hampshire	1-800-225-4977
New Jersey	Garden State Underground Plant Location Service	1-800-272-1000
New Mexico	New Mexico One Call System, Inc.	1-800-321-ALERT
New York	New York City - Long Island One Call Center	1-800-272-4480
	Underground Facilities Protective Organization "UFPO"	1-800-962-7962
North Carolina	The North Carolina One Call Center, Inc.	1-800-632-4949
North Dakota	Utilities Underground Location Center	1-800-454-5555
Ohio	Ohio Utilities Protection Service	1-800-362-2764
Oklahoma	Call Okie	1-800-522-6543
Oregon	Douglas Utilities Coordinating Council	503-673-6676
	Josephine Utilities Coordinating Council	503-476-6676

State	One-Call Agency	Number
	Josephine Utilities Coordinating Council	503-476-6676
	Rogue Basin Utility Coordinating Council	503-779-6676
	Utilities Notification Center	1-800-332-2344
	Utilities Underground Location Center	1-800-424-5555
Pennsylvania	Pennsylvania One Call System, Inc.	1-800-242-1776
Rhode Island	Dig Safe - Rhode Island	1-800-225-4977
South Carolina	Palmetto Utility Protection Service Inc. "PUPS"	1-800-922-0983
South Dakota	South Dakota One Call	1-800-781-7474
Tennessee	Tennessee One-Call System, Inc.	1-800-351-1111
Texas	Lone Star Notification Center	1-800-669-8344
	Texas Excavation Safety System (TESS)	1-800-344-8377
	Texas One Call System	1-800-245-4545
Utah	Blue Stakes Location Center	1-800-662-4111
Vermont	Dig Safe - Vermont	1-800-225-4977
Virginia	Miss Utility	1-800-257-7777
	Miss Utility of Delmarva	1-800-441-8355
	Miss Utility of Virginia	1-800-552-7001
Washington	Chelan-Douglas Utilities Coordinating Council	509-663-6111
	Grays Harbor & Pacific County Utility Coordinating Council	206-532-3550
	Inland Empire Utility Coordinating Council	509-456-8000
	Palouse Empire Utilities Coordinating Council	1-800-822-1974
	Upper Yakima County Underground Utilities Council	1-800-553-4344
	Utilities Council of Cowlitz County	360-425-2506
	Utilities Notification Center	1-800-332-2344
	Utilities Underground Location Center	1-800-424-5555
West Virginia	Miss Utility of West Virginia, Inc.	1-800-245-4848
Wisconsin	Diggers Hotline, Inc.	1-800-982-0299
Wyoming	Albany County Utility Coordinating Council	307-742-3615
	Call-in Dig-in Safety Council	307-382-9811
	Carbon County Underground Utility Coordinating Council	307-324-6666
	Central Wyoming Utilities Coordinating Council	1-800-759-8035

State	One-Call Agency	Number
	Converse County Utility Coordination Council	1-800-562-5561
	Fremont County Utility Coordinating Council	1-800-489-8023
	Southeast Wyoming Utilities Coordinating Council	307-638-6666
	Southwest Wyoming One Call	307-362-8888
	Utilities Underground Location Center	1-800-454-5555
	Wyoming One-Call	1-800-348-1030

CHECKLIST FOR IDENTIFYING UNDERGROUND INSTALLATIONS

Name of Contractor: _____

Location: _____ Project #:_____

Date: _____ Time: _____ Weather: _____

Person Conducting Inspection: _____ Title: _____

Responsibilities of the Excavator Contractor

Supply as much pertinent information as possible when calling in location (house #, pole #, facility #, landmark to measure distance, nearest intersection, etc.)

	Completed	N/A
Notify the One-Call Center 3 business days in advance but no more than 10 days prior to activities	☐	☐
Hand dig and locate within 2 feet of a mark out before operating any mechanized equipment	☐	☐
Mark and identify perimeter of proposed site of excavation in white where Appropriate	☐	☐
Protect and preserve markings, staking, or other designations until no longer necessary for safe excavation, demolition, or blasting	☐	☐
Obtain new ticket every 30 business days	☐	☐
Check surrounding area before excavating	☐	☐
Recordkeeping		
Confirmation number received	☐	☐
Copy of mark-out ticket readily available	☐	☐
Records have been maintained to document any damage	☐	☐

Comments:

_____

_____

_____

_____

Attachment E

HASP Amendments

PLEASE USE THIS DOCUMENT TO MAKE ANY CHANGES TO THE HEALTH AND SAFETY PLAN

Site Safety Plan Amendments

Amendment No.: _____

Client: National Fuel Gas Distribution Corp	**Project Number: 60250836**
Location: Mineral Springs Former MGP	**Date:**
Project Manager: Tamara Raby	**Site Engineer: Thomas Clark**
Site H&S Officer: Tamara Raby	
Amendment:	
Reason for Amendment:	
Alternative Safeguard Procedures:	
Required Changes in PPE:	

Site Health and Safety Officer _____ **Date** _____

EH&S Director _____ **Effective Date** _____

Attachment B

NYSDOH Special Requirements CAMP

SPECIAL REQUIREMENTS FOR WORK WITHIN 20 FEET OF POTENTIALLY EXPOSED INDIVIDUALS OR STRUCTURES

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.