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September 27, 2021

Mr. Girish Desai
Division of Environmental Remediation
New York State Department of Environmental Conservation
Building 40 – SUNY, Stony Brook
Stony Brook, New York 11790-2356

Subject: Columbia Cement Site, Freeport, Nassau County, New York
NYSDEC Registry Site No. 130052
Revised Emerging Contaminants Monitoring Work Plan

Dear Mr. Desai:

On behalf of BP UK Retained Holdings, AECOM Technical Services, Inc. (AECOM) has prepared this Revised Emerging Contaminants Monitoring Work Plan (Work Plan) for the Columbia Cement Site (Site) in Village of Freeport, Town of Hempstead, New York (Figure 1 – Site Location Map). On November 24, 2020 NYSDEC directed AECOM to perform various tasks at the Columbia Cement Site. These tasks included collecting and analyzing groundwater samples for emerging contaminants in accordance with recent NYSDEC guidance documents.

Background

In 2017, the New York State Department of Environmental Conservation (NYSDEC) undertook a state-wide evaluation of 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS) in state groundwater. This initiative was undertaken because these “emerging contaminants” (ECs) had been found in drinking water supplies in New York. As directed by NYSDEC, AECOM collected samples for 1,4-dioxane and PFAS compounds during the March 2017 Operable Unit No. 2 (OU-2) groundwater sampling event and the September 2017 Operable Unit No. 1 (OU-1) and OU-2 groundwater sampling event. PFAS compounds and 1,4-dioxane were detected in OU-1 and OU-2 groundwater.

NYSDEC had no Groundwater Quality Criteria for these emerging contaminants at the time of sampling, so results were compared to applicable United States Environmental Protection Agency (EPA) Health Advisory Levels. The Health Advisory Level for 1,4-dioxane was 0.35 micrograms per liter (µg/l). The Health Advisory Level for the PFAS compounds perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS) was 70 nanograms per liter (ng/l) for each compound. 1,4-dioxane was detected in OU-1 groundwater at concentrations ranging from 1.3 µg/l to 69 µg/l. PFOA was detected in OU-1 groundwater at concentrations ranging from 20 ng/l to 2,300 ng/l and PFOS was detected in OU-1 groundwater at concentrations ranging from 38 ng/l to 1,300 ng/l. 1,4- dioxane was detected in OU-2 groundwater at concentrations ranging from 0.24 µg/l to 29 µg/l. PFOA was detected in OU-2 groundwater at concentrations ranging from 1.7 ng/l to 210 ng/l and PFOS was detected in OU-2 groundwater at concentrations ranging from 2.4 ng/l to 200 ng/l. In August 2020, NYSDOH adopted drinking water standards for 1,4-dioxane (1 µg/l), PFOA (10 ng/l) and PFOS (10 ng/l). Groundwater in the vicinity of the Site is not utilized as a drinking water source. The 2017 PFOA, PFOS and 1,4-dioxane groundwater analytical results are presented in Table 1.

1,4-Dioxane has historically been used as a stabilizer for 1,1,1-trichloroethane (1,1,1-TCA), which was used by Columbia Cement during Site operation. The 1988 spill of 1,1,1-TCA could be the source of the 1,4-dioxane impacts. However, PFAS contamination is not generally associated chlorinated solvent use.

PFAS is often associated with aqueous film forming foam (AFFF) used in firefighting. It is not known if Columbia Cement (or successor TACC) used AFFF at the Site.

NYSDEC has requested that AECOM collect groundwater EC data in accordance with current NYSDEC guidance documents. This Work Plan presents a scope of work to assess current PFAS concentrations onsite and evaluate groundwater flow directions.

Scope of Work

To meet NYSDEC's requirement to evaluate the current concentrations and distribution of PFAS and 1,4-dioxane at the Site and off-Site, AECOM will perform a scope of work that includes:

- Review of historical information to assess potential PFAS sources;
- Repair and/or replacement of select damaged wells at OU-1 and OU-2;
- Monitoring groundwater levels at the Columbia Cement site and Freeport Creek over multiple tidal cycles; and
- Collection of groundwater samples.

Samples will be collected and analyzed in accordance with the guidance information included with the January 2021 NYSDEC guidance document *Sampling, Analysis and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs* (NYSDEC PFAS Guidance Document, January 2021).

The above summarized scope of work is presented in more detail in the following sections.

Historical Document Review

AECOM will review historical documents related to both 159 Hanse Avenue and 272 Buffalo Avenue for indications of historical use of PFAS-containing substances. As PFAS is an "emerging contaminant," it is unlikely that historical documents contain relevant information. AECOM has submitted a Freedom of Information Law (FOIL) request to NYSDEC for information on environmental investigations and remediation at 272 Buffalo Avenue. AECOM has also obtained a historical environmental data base for 272 Buffalo. This information will be reviewed, and any relevant findings will be presented to NYSDEC. AECOM has also submitted a FOIL request to the Village of Freeport for any records related to fires at 159 Hanse Avenue and whether AFFF was used to fight the fire(s). Any relevant findings from the FOIL request will be presented to NYSDEC.

Utility Clearance

AECOM will employ multiple measures to prevent contact with subsurface utilities during drilling. Prior to any drilling activities, AECOM's drilling contractor will request a utility markout from the New York "Dig-Safe" service for the drilling area. AECOM will also retain a private utility locator who will use ground-penetrating radar and electromagnetic methods to scan the drilling areas for subsurface utilities. In addition, each boring location will be cleared to a depth of five feet with a hand auger or other non-mechanical means. If conflicts with subsurface or overhead utilities are discovered, the boring location will be moved accordingly.

Monitoring Well Repair / Replacement

Some OU-1 and OU-2 monitoring wells have been damaged over time and AECOM recommends that existing wells MW-97-1S, MW-98-9D and MW-05-14S be repaired if possible. Wells MW-97-1S and MW-98-9D are located in the southwest corner of OU-1 adjacent to the loading dock in the shared driveway between 159 Hanse Avenue and 191 Hanse Avenue. The asphalt driveway has degraded over time. The concrete well pads have crumbled, and the wells have filled with debris. MW-05-14S is located on the west side of Hanse Avenue, across from the Columbia Cement loading dock. The steel well cover was damaged and the well filled with sediment. NYSDEC has requested that these wells be repaired or replaced. Well MW-97-3S is located at the northeast corner of OU-1. The well is near the shared boundary between 159 Hanse Avenue and 143 Hanse Avenue. The occupant of 143 Hanse Avenue, Gershow Recycling (Gershow) has extended their fencing close to the well location. The well was covered during this expansion and has not been sampled since 2010. NYSDEC has requested that MW-97-3S be located, repaired, or replaced so that it can be sampled. AECOM recently located MW-97-3S beneath debris and it is in good condition.

Debris will be removed from the well(s) and new concrete pads, protective covers and locking caps will be placed on the wells. The wells will be re-developed until free of sediment. If the well(s) cannot be repaired, the existing well will be abandoned in accordance with NYSDEC requirements. Any abandoned well will be replaced by a well of similar construction in a location as close to the abandoned well as possible. Wells will be installed using hollow stem augers. Soil cuttings will be contained in 55-gallon drums and stored at the former Columbia Cement building pending subsequent off-site disposal after prior approval from NYSDEC. The replacement well(s) will be constructed of 2-inch inner diameter (ID), Schedule 40 PVC screen and riser pipe with a threaded bottom cap. The screens will be 10 feet in length with No. 10 (0.010 inch) slot. In each well a sand pack will be placed in the annular space from the bottom of the well to 1 foot above the top of the well screen. A bentonite seal will be placed above the sand pack. The seal will be at least 2 feet thick. A cement-bentonite grout will be placed from the top of the bentonite seal to approximately 3 feet below grade. Each well will be finished with a flush-mount steel cover set in concrete, and a water-tight locking cap. Wells will be installed with the same screen interval as the well it replaced. After repair or replacement, the wells will be surveyed by a New York-licensed surveyor. The well coordinates will be surveyed in New York State Plane Coordinates. The elevation of the ground surface and the top of the PVC casing will be surveyed to the nearest 0.01 feet.

Based on recent site reconnaissance with a drilling contractor in April 2021, wells MW-97-1S and MW-98-9D cannot be repaired/replaced at this time while the driveway is in its current degraded condition. Without cohesive pavement surrounding the well pads, any repaired or replaced wells will likely be damaged again in a short time by the frequent truck traffic. There are also numerous subsurface utilities in that area of the driveway, including water, gas, and sewer lines, leaving limited room for new wells. The repair/replacement of MW-97-1S and MW-98-9D will need to be delayed until the driveway is repaved. In the interim, AECOM recommends that samples be collected from wells OW-1 and OW-2 in the adjacent loading dock. Wells OW-1 and OW-2 have the same screen intervals as MW-97-1S and MW-98-9D, respectively, and are proposed for use to collect representative samples until the monitoring wells are repaired.

Monitoring Well Installation

To assess deeper groundwater conditions in the northeast portion of the Site, a deep well will be installed near shallow well MW-97-3S (MW-21-3D). The well location will be cleared using either a hand auger or other non-mechanical means to a depth of 5 feet. Continuous soil samples will be collected from 5 feet below grade to the end of the boring. The boring will be terminated at the lower confining clay layer (approximately 35 feet below grade). Soils will be screened with a calibrated photoionization detector

(PID) and the lithology will be logged. Soil cuttings will be contained in 55-gallon drums and stored at the former Columbia Cement building pending subsequent off-site disposal.

The well will be constructed of 2-inch ID, Schedule 40 PVC screen and riser pipe with a threaded bottom cap. The screen will be 10 feet in length with No. 10 (0.010 inch) slot. The well will be screened across the 10-foot interval immediately above the lower confining clay layer (approximately 25 to 35 feet below grade). A sand pack will be placed in the annular space from the bottom of the well to 1 foot above the top of the well screen. A bentonite seal will be placed above the sand pack. The seal will be at least 2 feet thick. A cement-bentonite grout will be placed from the top of the bentonite seal to approximately 3 feet below grade. The well will be finished with a flush-mount steel cover set in concrete, and a water-tight locking cap.

Surveying

After installation, wells, MW-21-3D, MW-97-1S and M-98-9D will be surveyed by a New York-licensed surveyor. In addition, the existing wells used for groundwater level monitoring (below) will also be surveyed. The well will be surveyed in New York State Plane Coordinates. The elevation of the ground surface and the top of the PVC casing will be surveyed to the nearest 0.01 feet.

Groundwater Level Monitoring

To evaluate groundwater flow direction(s), groundwater level monitoring will be performed. Since water levels in the Site vicinity are tidally influenced, monitoring will be done over multiple tidal cycles. Micro-Diver® pressure transducer/dataloggers (Van Essen) will be installed in the following monitoring wells: MW-1S, MW-1D-97, MW-98-8S, MW-98-8D, MW-97-3S, new well MW-21-3D, MW-97-4S, MW-00-12D, MW-97-1S, MW-98-9D, MW-97-2S, MW-98-10D, MW-05-14S, MW-05-15D, MW-09-24S, MW-09-25D, MW-17-28S and MW-17-29D. If wells MW-97-1S and MW-98-9D are not repaired/ replaced prior to the groundwater level monitoring, wells OW-1 and OW-2 will be utilized as replacements since they have already been previously surveyed for elevation and are suitable for use in assessing groundwater elevation in the area. The wells in which groundwater level monitoring will be performed are shown in Table 1.

One Micro-Diver® will also be installed in Freeport Creek behind 146 Hanse Avenue to record surface water levels. The Micro-Divers® will be programmed to record water levels every 15 minutes. Water levels will be monitored for a period of at least 26 hours so that at least two complete tidal cycles are included in the monitoring period. One Baro-Diver® will be run for the same period to record barometric pressure so that any necessary barometric pressure corrections can be made. The groundwater level monitoring will not be performed during a period with significant precipitation during or within the preceding 24 hours.

Groundwater Sampling

At least 7 days after completion of well repair/replacement and installation, groundwater samples will be collected from selected wells. The wells to be sampled are presented in Table 1.

The groundwater sample from each well will be analyzed for the following parameters:

- Volatile organic compounds (VOCs) by EPA Method 8260C;
- 1,4-dioxane by EPA Method 8270 Selective Ion Monitoring (SIM); and,
- 21 PFAS compounds listed in Appendix G of the NYSDEC PFAS Guidance Document by EPA Method 537.1 Modified (low level).

VOC analysis is being performed to obtain up-to-date groundwater VOC levels. In addition, 1,4-dioxane and PFAS are being analyzed because they were only analyzed for once in 2017. An additional data set will give an indication of either increasing or decreasing concentration trends. To the extent possible, the sampling will be timed to coincide with the semi-annual OU-2 groundwater monitoring event tentatively scheduled for August 2021.

The samples will be collected by personnel trained to perform PFAS sampling. Since PFAS are to be analyzed, the following techniques will be used in conjunction with, or instead of, the normal Site sampling methods:

- Use only laboratory certified "PFAS-free" water for equipment decontamination.
- Use only Alconox® or Liquinox® soap for decontamination.
- No Sharpies will be used, only ball point pens.
- No waterproof field books/ laboratory notebooks, only loose paper on aluminum clipboards.
- Do not wear the following:
  - Personal hygiene items (cosmetics, lotions, moisturizers).
  - Sunscreens and insect repellants. Instead, wear long sleeve / light colored 100% cotton shirts and wide brimmed hats.
  - New or unwashed clothing.
  - Clothing washed with fabric softeners.
  - Treated clothing (i.e., waterproof, water resistant, stain-resistant, etc.).
  - Treated boots (i.e., waterproof, water resistant, stain-resistant, etc.).
  - Coated Tyvek® suits.
- Do not handle prepackaged food products immediately prior to sampling.
- Wear a new pair of disposable powderless nitrile gloves prior to sample collection.
- Do not use fluoropolymer bailers, pump bladders, tubing, valves, and other pump parts.
- Do not use anything with Teflon®.
- Use HDPE and silicon materials only.
- Do not use glass containers for sampling. Use only bottleware provided by the laboratory (i.e., polypropylene or HDPE sample bottles with unlined [no Teflon®] polypropylene or HDPE screw caps).
- Do not use aluminum foil.
- Do not filter samples in the field.

Samples will be delivered to Eurofins-Lancaster Laboratories, Inc. of Lancaster, Pennsylvania a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program-(ELAP) approved analytical laboratory. Standard laboratory turn-around time [10 business days] will be requested.

Purged groundwater will be transferred to appropriate on-site containers for appropriate characterization and disposal.

Waste Disposal

Soil cuttings generated during drilling will be placed in 55-gallon drums, labeled as non-hazardous waste, and staged on-Site for subsequent disposal at a licensed facility. All cuttings generated will be treated as non-hazardous waste, and will be disposed of off-site at a permitted facility. The soil will be characterized as required by the disposal facility. After facility acceptance and approval by NYSDEC, the soil will be removed from the Site for disposal.

Well development and purge water will be placed in 55-gallon drums, labeled as non-hazardous waste, and staged on-Site for subsequent disposal at a licensed facility. The water will be characterized as

required by the disposal facility. After facility acceptance and approval by NYSDEC, the water will be removed from the Site for disposal.

Health and Safety

All work will be performed in accordance with AECOM's site-specific Health and Safety Plan (HASP). During all ground-intrusive activities, air monitoring will be performed in accordance with the NYSDEC-approved Community Air Monitoring Plan (CAMP). The CAMP is presented in Appendix A and presents a plan for monitoring the downwind perimeter of the work area for VOC and particulates to assure that Site work does not impact the surrounding community. AECOM's site-specific HASP is presented in Appendix B. The HASP was reviewed and approved by a qualified health and safety professional in accordance with the most recently adopted and applicable general industry (29 CFR 1910) and construction (29 CFR 1926) standards of OSHA, the U.S. Department of Labor, as well as any other federal, state or local applicable statutes or regulations. The drilling subcontractor's site-specific HASP is presented as Appendix C. Both AECOM's and the driller's HASPs will be available on-site during the performance of activities to which they are applicable and will be adhered to by all field personnel.

Quality Assurance

The contracted laboratory has stated that they can achieve a method detection limit of 2 ng/l for each PFAS target analytes provided in the table below:

	Chemical Name	Abbreviation	CAS Number
1	Perfluorobutanesulfonic acid	PFBS	375-73-5
2	Perfluorohexanesulfonic acid	PFHxS	355-46-4
3	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
4	Perfluorooctanesulfonic acid	PFOS	1763-23-1
5	Perfluorodecanesulfonic acid	PFDS	335-77-3
6	Perfluorobutanoic acid	PFBA	375-22-4
7	Perfluoropentanoic acid	PFPeA	2706-90-3
8	Perfluorohexanoic acid	PFHxA	307-24-4
9	Perfluoroheptanoic acid	PFHpA	375-85-9
10	Perfluorooctanoic acid	PFOA	335-67-1
11	Perfluorononanoic acid	PFNA	375-95-1
12	Perfluorodecanoic acid	PFDA	335-76-2
13	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
14	Perfluorododecanoic acid	PFDoA	307-55-1
15	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
16	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
17	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
18	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
19	Perfluoroctanesulfonamide	FOSA	754-91-6
20	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
21	N-ethyl perlfuorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Additionally, the contracted laboratory has indicated that they can achieve a method detection limit of 0.28 µg/L for 1,4-dioxane.

One field duplicate, one equipment blank, and one matrix spike/matrix spike duplicate sample will be collected for every 20 samples. Equipment blanks will be collected with PFAS free water supplied by the laboratory. A summary of the QA/QC samples is shown on Table 1. The laboratory will provide the

results in an Analytical Services Protocol (ASP) Category B equivalent data deliverable. A Data Usability Summary Report (DUSR) will be performed for all data acquired and included with the groundwater sampling summary report. All data from this sampling event will be uploaded to the NYSDEC EQuIS database.

Schedule

AECOM will initiate the field program when NYSDEC approves this Work Plan and upon obtaining an access agreement with the new property owner. The monitoring well repair/replacement/installation activities will occur first. Groundwater level monitoring and monitoring well sampling will take place at least one week after well development / redevelopment. NYSDEC will be provided at least seven-day advance notice of the planned sampling date.

Reporting

The results of this Emerging Contaminants Monitoring will be provided to NYSDEC as a stand-alone summary letter report upon the completion of groundwater sampling and data assessment activities. The report will include an assessment of current contaminant concentrations and any notable changes since the 2017 sampling. The report will include recommendations for any additional investigation that may be needed to further assess contaminant sources and/or receptors. The letter report will be submitted to NYSDEC within 45 days of receipt of laboratory data.

If you have any questions or comments, please contact me at (973) 883-8500.

Sincerely yours,

AECOM Technical Services, Inc.

Mark Becker, PG
Columbia Cement Task Leader
mark.becker@aecom.com

Attachments:
Table 1
Figures 1 and 2
Appendix A – Community Air Monitoring Plan
Appendix B – AECOM Health and Safety Plan
Appendix C – Drilling Subcontractor Health and Safety Plan

cc: Mr. Daniel Tucholski, NYSDOH, Albany

TABLES

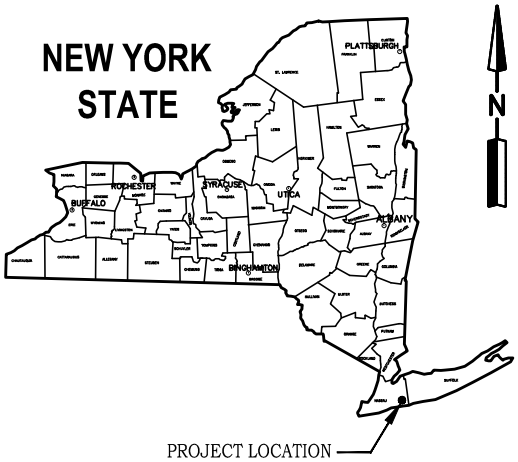
TABLE 1
EMERGING CONTAMINANT MONITORING PROGRAM
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

OPERABLE UNIT	WELL ID	2017 PFAS and 1,4-D SAMPLING RESULT			DECEMBER 2020 VOC SAMPLING RESULT			WELLS TO BE USED FOR WATER LEVEL MONITORING	WELLS TO BE SAMPLED	COMMENT
		PFOA ng/l	PFOS ng/l	1,4-D µg/l	1,1,1-TCA µg/l	1,1-DCA µg/l	CA µg/l			
OU-1	MW-1S	**880**	**450**	**2**	0.56 J	0.97 J	< 1.0	X	X	
	MW-1D-97	**1,900**	**750**	**6**	1.0 UJ	4.2 J	1.0 U	X	X	
	IP1-4D	**350**	**150**	**2.2**	**32**	**19**	**260**			
	IP1-7I	**370**	**180**	**1.3**	**38**	**27**	**340**			
	IP1-8D	**370**	**110**	**2.7**	1.0 U	0.25 J	**71**			
	IP2-8	**2,300**	**600**	**6**	1.0 U	0.93 J	**9.4**		X	Highest 2017 PFOA concentration.
	IP3-2	**170**	**120**	**16**	1.3	**23**	**160**			
	IP4-6	**500**	**200**	**1.3**	1.0 U	1.0 U	**71**			
	MW-98-8S	**1,600**	**700**	**26**	1.0 U	1.0 U	0.23 J	X	X	Upgradient boundary.
	MW-98-8D	**1,900**	**1,300**	**9**	1.0 U	0.46 J	1.0 U	X	X	Upgradient boundary, Highest 2017 PFOS.
	MW-97-3S	N/A	N/A	N/A	N/A	N/A	N/A	X	X	Well located.
	MW-21-3D	N/A	N/A	N/A	N/A	N/A	N/A	X	X	To be installed near MW-97-3S
	MW-97-4S	**370**	**170**	**11**	1.0 U	1.0 U	**6.2**	X	X	
	MW-00-12D	**720**	**360**	**4**	1.0 U	0.6 J	1.0 U	X	X	
	MW-97-6S	**52**	**110**	**60**	1.0 U	1.0 U	**28**			
	MW-97-1S	**20**	**44**	**14**	NS	NS	NS	X	X	Well damaged, to be replaced.
	MW-98-9D	**150**	**260**	**69**	NS	NS	NS	X	X	Well damaged, to be replaced.
	OW-1	N/A	N/A	N/A	1.0 U	1.0 U	3.7	X*	X*	*To be used if MW-97-1S is not accessible
	OW-2	N/A	N/A	N/A	1.0 U	1.0 U	**200**	X*	X*	*To be used if MW-98-9D is not accessible
	OW-3	**44**	**38**	**7.7**	1.0 U	1.0 U	1.0 U		X	
	OW-4	**290**	**390**	**18**	1.0 U	1.3	1.0 U		X	
	MW-97-2S	**260**	**200**	**4.5**	1.0 U	1.0 U	1.0 U	X	X	
	MW-98-10D	**220**	**190**	**6.9**	1.0 U	1.0 U	1.0 U	X	X	
OU-2	MW-03-13S	**23**	**36**	0.24	NS	NS	NS			
	MW-05-14S	1.7	2.0 U	**29**	NS	NS	NS	X	X	Well damaged, to be repaired.
	MW-05-15D	9	2.4	**9.5**	1.0 U	1.0 U	0.23	X	X	
	MW-09-18S	**53**	**33**	**3.4**	1.0 U	1.0 U	2.4			
	MW-09-19D	**210**	**200**	**7.6**	1.0 U	1.0 U	1.3			
	MW-09-20S	8.8	7.1	2.0 U	1.0 U	1.0 U	1.0 U			
	MW-09-21D	**78**	**72**	**6.8**	NS	NS	NS			
	MW-09-22S	**28**	**45**	**1.6**	NS	NS	NS			
	MW-09-23D	**19**	**17**	**2.6**	NS	NS	NS			
	MW-09-24S	2.4	2.0 U	2.0 U	1.0 U	1.0 U	1.0 U	X	X	
	MW-09-25D	**120**	44	**12**	1.0 U	1.0 U	**110**	X	X	
	MW-09-26D	**40**	**36**	0.47	1.0 U	1.0 U	0.65 J			
	MW-17-27S	8.3	**16**	**2.37**	10 U	10 U	10 U			
	MW-09-28S	**77**	**55**	**9**	NS	NS	NS	X	X	
	MW-09-29D	2.8	5.2	**1.3**	NS	NS	NS	X	X	
		SUBTOTAL						18	21	
QA/QC Samples		Field Duplicates							2	
		Matrix Spike (MS)							2	
		Matrix Spike Duplicate (MSD)							2	
		Equipment Blanks							3	
		SUBTOTAL							9	
		TOTAL							30	

Notes

PFOA : Perfluorooctanoic acid
PFOS : Perfluorooctanesulfonic acid
1,4-D : 1,4-Dioxane
1,1,1-TCA : 1,1,1-trichloroethane
1,1-DCA : 1,1-dichloroethane
CA : chloroethane
ng/l : nannograms per liter
µg/l : micrograms per liter
U : Not detected at stated reporting limit.
NS : Not Sampled
N/A : Not applicable
BOLD : Concentration exceeds applicable NYSDEC criteria.

FIGURES



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0 2000 4000

SCALE IN FEET

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE:
FREEPORT, NY (2010)

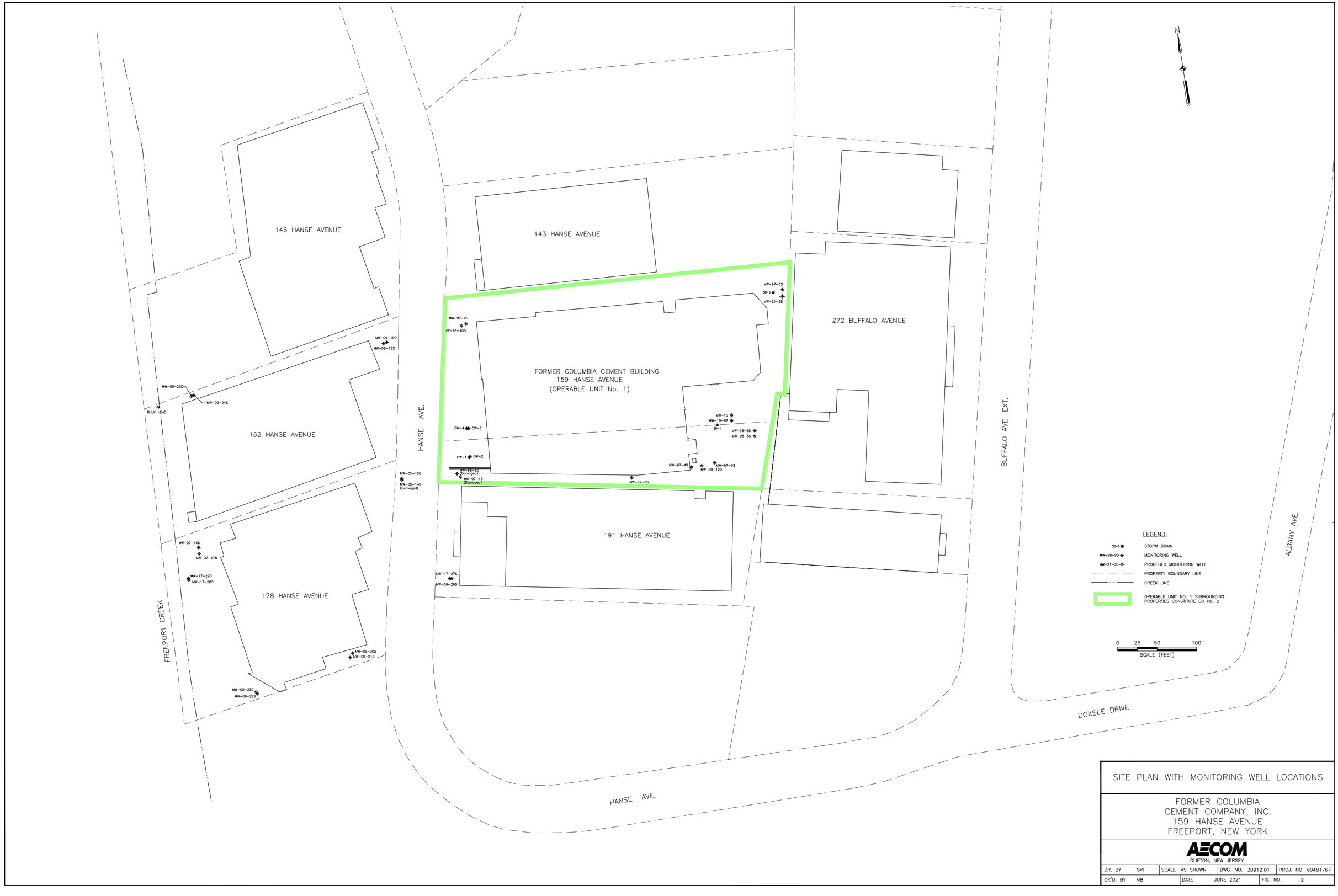
SITE LOCATION MAP
FORMER COLUMBIA CEMENT COMPANY, INC.
SITE NO. 130052
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
1255 Broad Street
Clifton, New Jersey 07013
PHONE: (973) 883-8500
FAX: (973) 883-8501

DATE: 01/23/15
JOB: 11130912

FIGURE 1

K:\Cadd\Columbia Cement\Columbia Cement-Unit No.2\11130912(Unit.No.2)\30912.01-FIG.1.dwg, 5/5/2016 9:22:57 AM



SITE PLAN WITH MONITORING WELL LOCATIONS

FORMER COLUMBIA
CEMENT COMPANY, INC.
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	SVI	SCALE	AS SHOWN	DWG. NO. 30912.01	PROJ. NO. 60481767
CK'D. BY	MB	DATE	JUNE 2021	FIG. NO.	2

APPENDIX A
COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN

OPERABLE UNIT NO. 1

FORMER COLUMBIA CEMENT COMPANY SITE

FREEPORT, NEW YORK

SITE NUMBER 130052

Prepared for:
BP UK Retained Holdings
201 Helios Way
Helios Plaza 6.370A
Houston, Texas 77079

Prepared by:
AECOM
1255 Broad Street
Suite 201
Clifton, New Jersey 07013

1.0 INTRODUCTION

The Former Columbia Cement Company (CCC) Site located at 159 Hanse Avenue (Site) has undergone extensive environmental investigation in response to a 1988 release of 1,1,1-trichloroethane (TCA). A supplementary Remedial Investigation Report was submitted to NYSDEC in December 2006 and a Feasibility Study Report was submitted in February 2008. A Record of Decision was prepared by NYSDEC in March 2008, indicating selected remediation/mitigation measures for impacted soil, groundwater, and soil vapor. The remediation/mitigation measures commenced in 2008. AECOM (formerly URS Corporation) has prepared this Community Air Monitoring Plan (CAMP) to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. Protection of Site workers will be addressed through a site-specific Health and Safety Plan (HASP).

2.0 BACKGROUND

The site building was constructed in 1969 on the location of a former municipal landfill. From 1969 to 1996, Columbia Cement produced adhesives in the Site building, including solvent-base adhesives. Multiple above-ground and underground storage tanks were present at the Site containing solvents, raw materials and other materials. In 1988, a tanker truck offloading material ruptured and approximately 1,760 gallons of TCA was spilled to the ground surface and flowed to a storm drain in the UST area. Since then the Site has undergone numerous investigations, documented in other submittals. In December 2003 Delaware Engineering submitted a Remedial Investigation Report. URS Corporation submitted a Supplemental Remedial Investigation Report in December 2006. The remedial investigation activities revealed that the soil and groundwater at the Site are impacted with 1,1,1-TCA, its degradation daughter products, other solvents utilized in adhesive manufacturing and stored on Site, as well as other constituents likely related to the former municipal landfill. These soil and groundwater impacts have also created soil vapor contamination.

In January 2007, URS submitted a draft Feasibility Study Report, evaluating potential remedial alternatives. NYSDEC and NYSDOH requested further off-site investigation. When groundwater contamination of spill-related compounds was detected near Freeport Creek, NYSDEC divided the Site into two Operable Units. Operable Unit 1 (OU-1) is the onsite project area and includes the former CCC property, currently owned by Freeport 159, LLC. OU-2 is the

offsite area including downgradient properties located between Hanse Avenue and Freeport Creek and areas immediately surrounding OU-1. The Final Revised FS addressing OU-1 was submitted to NYSDEC on February 18, 2008. NYSDEC prepared the Proposed Remedial Action Plan (PRAP) in February 2008 based on this FS and selected in-situ chemical oxidation (ISCO), in-situ bioremediation and sub-slab depressurization alternatives to address soil, groundwater and soil vapor impacts, respectively, at the Site within OU-1. All of these measures involve ground-intrusive activities that could result in the release of subsurface contaminants to the atmosphere. The Record of Decision (ROD) for the OU-1 selecting the above remedies was issued by NYSDEC in March 2008. Since 2008, multiple rounds of ISCO injections have been conducted at the site.

3.0 COMMUNITY AIR MONITORING PLAN

This Community Air Monitoring Plan was prepared to present a description of air monitoring activities to be performed during ground-intrusive activities at the Site. Other Site activities will be addressed under separate CAMPs.

3.1 GROUND-INTRUSIVE ACTIVITIES

Ground intrusive activities include, but are not limited to, the installation of soil borings or monitoring wells. During ground intrusive activities, real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be necessary. Continuous monitoring will be required for all ground intrusive activities.

3.2 NON-INJECTION ACTIVITIES

Periodic monitoring for VOCs will be required during non-injection activities such as the collection of groundwater samples from existing monitoring wells or management of drums of waste. "Periodic" monitoring during sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or drum, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location.

3.3 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

During ground-intrusive activities, volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Wind direction will be determined by observing a wind direction indicator suspended near the work zone. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions, and/or if the work

location changes. Wind direction and the location of upwind and downwind monitoring locations will be recorded on a map during each day of ground-intrusive activities. The monitoring work will be performed using equipment appropriate to measure the contaminants known or suspected to be present (a PID with an 11.7 eV lamp). The equipment will be calibrated at least daily. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. Calibration information will be recorded in a CAMP Log Book.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued, and NYSDEC and NYSDOH project managers will be notified. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. The NYSDEC and NYSDOH project managers will be notified. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shut down and the Nassau County Department of Health and NYSDEC will be notified.

All 15-minute readings will be logged by the instrument, downloaded to a computer daily and be available for State (DEC and DOH) personnel and local (county or municipal) health departments to review. Instantaneous readings, if any, used for decision purposes will be recorded in a CAMP Log Book.

3.6 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate monitoring will be performed during any ground-intrusive activities, such as drilling. Particulate concentrations will be monitored at the start of the day and periodically at the upwind perimeter of the exclusion zone. Particulate concentrations will be monitored continuously at the downwind perimeters of the exclusion zone at a temporary particulate monitoring station. The

particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. In addition, fugitive dust migration will be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed and the NYSDEC and NYSDOH project managers will be notified. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work will be stopped and a re-evaluation of activities initiated. The NYSDEC and NYSDOH project managers will be notified. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be logged by the instrument, downloaded to a computer daily and be available for State (DEC and DOH) personnel and local (county or municipal) health departments to review.

3.7 NUISANCE ODOR MONITORING, RESPONSE LEVELS, AND ACTIONS

Periodic monitoring of nuisance odors will be conducted at the downwind perimeter of the exclusion zone by smelling the ambient air. If nuisance odors are detected the work area will be checked to evaluate whether the odors are emanating from the source area. Other businesses in the area may produce nuisance odors. If the origin of the nuisance odors is determined to be the work area, work will be stopped and a re-evaluation of activities initiated. Hydrogen sulfide has a distinctive odor, but those who smell it are quickly subject to olfactory fatigue. If site-related nuisance odors (i.e. VOCs and/or hydrogen sulfide) are noted, monitoring with a PID and/or multi-gas meter will be conducted at that location until readings return to background levels.

APPENDIX B
AECOM HEALTH AND SAFETY PLAN

ERP & HASP

EMERGENCY RESPONSE PLAN & HEALTH AND SAFETY PLAN

Former Columbia Cement Company

IPO US NY Columbia Cement

159 Hanse Avenue
Freeport, New York 11520
United States

40.647100, -73.571384

60481767 - BP IPO .....Task 104

Prepared for

BP Remediation Management
Helios Plaza – 6th Floor
201 Helios Way
Houston, Texas 77079
United States

Prepared by

AECOM

125 Broad Street, 16th Floor
Manhattan, New York 10004
United States

Preparer: Carolyn Hardt Geologist II	Signature	Date Prepared: 07/23/2021
Task Manager: Mark Becker Task Manager	Signature	Date Reviewed: 07/28/2021
EBL/Client Account SH&E Manager: Timothy J. Gilles, STS Manager, Safety, Health & Environment	Signature ELECTRONIC SIGNATURE - FY2021	Date Approved: 07/28/2021

Expiration: July 28, 2022	Valid for one (1) year maximum or until the scope of work, methods and/or equipment change.

EMERGENCY CONTACTS QUICK REFERENCE

Emergency Responders

Site Resource(s):		NA	NA
Fire:		Freeport Fire Department	1-516-378-0400 or 911
Medical Transport:	Land:	Ambulance	911
	Air:	NA	NA
	Water:	NA	NA
Police:		Freeport Police Department	1-516-378-0700 or 911
Poison Control:		American Assoc. of Poison Control Centers	800-222-1222
Pollution Emergency:		National Response Center	800-424-8802
INFO TRAC:		(AECOM's Account Number: 74984)	800-535-5053

Incident and Medical Treatment Resources

AECOM DCSA Incident Hotline:	Toll-Free, Available 24 / 7	800-348-5046
AECOM Occupational Nurse:	Available 24 / 7	512-419-5016
Nearest Hospital:	South Nassau Communities Hospital	1-516-632-3000
Nearest Occupational Clinic:	City MD Urgent Care	1-516-584-4448
Fleet Vehicle Management:	ARI Fleet Management	800-422-7647

Key Personnel

Role	Person Assigned to Role	Contact No. Primary		Contact No. Alt.	
AECOM Site Supervisor:	Sunil Samaroo	D	1-973-883-8534	-	n/a
AECOM Site Safety Officer:	Sunil Samaroo	D	1-973-883-8534	-	n/a
AECOM Task Manager:	Mark Becker	D	1-973-883-8696	M	1-908-347-7234
AECOM TM Alternate:	Akta Patel	D	1-973-883-8548	D	1-973-699-4234
Client Account SH&E Manager:	Timothy J. Gilles, STS	M	312-833-5991	D	630-829-2736
REM East SH&E Manager:	Pete Wray	M	302-660-9178	D	302-318-2880
AME ENV SH&E Director:	Candice Johnson	M	416-407-9661	-	n/a
AECOM BP Program Manager:	Dave Espy	D	978-905-2195	M	508-735-1462
AECOM Client Account Manager:	Michael Clark	M	713-417-7171	D	281-675-1727
Host Facility Contact:	Alex Sands – AJM Realty	O	1-516-743-9118	-	n/a
BP Project Manager:	Jim Smith	M	630-379-8879	D	832-619-3585
BP PM's Line Manager:	Ron Halsey	M	714-746-4227	D	562-512-1056
BP HSSE Advisor:	R.C. Strain	M	281-896-6470		

Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone

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ATTACHMENTS

Attachment A: Applicable AECOM SH&E Field Procedures

Attachment B: Stretch and Flex Poster

Attachment C: Task Hazard Assessments (THAs)

Attachment D: Site Orientation

Attachment E: Safety Data Sheets (SDSs)

Attachment F: Work and Project Plans, Specifications, and/or Drawings

Attachment G: Client-Specific Requirements and Documents [Includes BP's Golden Rules of Safety]

EMERGENCY RESPONSE PLAN (ERP)

Note: This document is intended to provide key information for responding to emergency situations and must be accompanied by the Site Health and Safety Plan.

1.0 SITE INFORMATION

1.1 SITE NAME AND LOCATION

Site Name: Former Columbia Cement Company

AECOM-BP Acct Site ID:	IPO US NY Columbia Cement		
Street Address/Location:	159 Hanse Avenue		
City:	Freeport		
State/Province:	New York	Country:	United States
Latitude:	40.647100	Longitude:	-73.571384

1.2 CLIENT INFORMATION

Client Name: BP

Business Unit:	Functions (FUNC)	
Segment Practice Unit:	Remediation Management (RM)	
SPU Division:	☐ Decommissioning	☐ Retail, Pipelines & Terminals
	☐ Mining	☐ U.S. Assets
	☐ Mergers & Acquisitions	☒ Other (Procurement)

2.0 EMERGENCY RECOGNITION AND IMMEDIATE ACTION

Any situation that has resulted or poses an imminent threat to persons, property and/or the environment constitute an emergency an require immediate action by the individual discovering and/or involved in the situation. Immediate actions start with the signaling of an emergency that is accompanied by a ceasing of site activities (i.e. Stop Work). When safe to do so, immediate actions will be taken to prevent an imminent risk from resulting in an incident and/or minimize the potential for an escalation in the severity of the incident. Immediate actions for reasonably credible emergency situations or scenarios are described within the following section of this ERP.

2.1 COMMUNICATION – METHOD OF SIGNALING AN EMERGENCY

In addition to verbal communication amongst the field team, the following methods of communicating or signaling an emergency will be used:

☒ Cell Phone ☐ Hand Signal	☐ Radio (Channel No. [Insert])		☐ Satellite Phone
☐ Host Facility Alarm (specify):	NA	=	NA

2.2 MUSTER AND SHELTER-IN-PLACE LOCATIONS

In the event of an emergency situation or imminent threat persons, property and/or environment, workers will report to the appropriate muster and/or shelter-in-place location. Workers will remain at the muster or shelter-in-place location until a headcount is completed and any "all clear" is issued by the proper authority for the site, unless it is unsafe to remain at that location.

Primary Muster Location:	Farber Plastics Parking Lot
Secondary Muster Location:	Vehicle
Shelter-in-Place Location:	Vehicle

2.3 LOCATION OF EMERGENCY EQUIPMENT

Site personnel will be made aware of the location of emergency equipment that can aid in the response to an emergency situation or imminent threat to persons, property and/or the environment during the site orientation, daily toolbox safety meetings, and/or crew reviews.

Item(s)	Item Description	Location(s)
First Aid Kit(s)	ANSI Z308.1 (2015) Type III, Class A	• AECOM Field Vehicle
Automated External Defibrillator(s)	Standard AED	• n/a
Fire Extinguisher(s)	5lb, Class C	• AECOM Field Vehicle
Spill Kit(s)	n/a	• ISCO Mixing Station

2.4 EMERGENCY RESPONDERS AND RESOURCES

In the event of a life-threatening or critical emergency, AECOM employees should immediately engage emergency responders and/or resources, as appropriate, to the type of emergency. Steps should be taken to meet and escort emergency responders and/or resources to location of the emergency whenever possible. Note: A life-threatening or critical emergency can include:

- ✓ Loss of consciousness
- ✓ Seizures
- ✓ Uncontrolled loss of blood
- ✓ Broken bones
- ✓ Severe allergic reaction
- ✓ Head or spinal cord injury
- ✓ Heat Stroke
- ✓ Abdominal trauma
- ✓ Difficulty breathing
- ✓ Cardiac arrest

Emergency Responders

Site Resource(s):	None	n/a

Fire:	Freeport Fire Department	EMERGENCY:	911
		NON-EMERGENCY:	1-516-378-0400
Medical Transport:	Land: Ambulance		911
	Air: NA		NA
	Water: NA		NA
Police:	Freeport Police department	EMERGENCY:	911
		NON-EMERGENCY:	1-516-378-0700
Poison Control:	American Assoc. of Poison Control Centers		800-222-1222
Pollution Emergency:	National Response Center (U.S. EPA)		800-424-8802
INFO TRAC:	(AECOM's Account Number: 74984)		800-535-5053

Utility and Pipeline Owners (For utility and pipeline related emergencies only)

Utility/Pipeline Name	Provider/Facility Owner	Contact No.
Cable	Verizon	516-223-1111
Electric	Freeport Electric	516-337-2262
Natural Gas	PSEG Long Island	800-490-0025
Phone	Verizon	516-223-1111
Water	Freeport Water	516-377-2379
Sewer	Freeport Public Works	516-377-2375
Call Before You Dig	(Utility One-Call Locating)	811

3.0 NOTIFICATIONS AND REPORTING

Once immediate actions have been taken, if safe to do so, notifications (verbal) and reporting (written) must be completed. Notifications serve to engage additional resources in the management of the emergency situation and initiate additional processes such as medical case management, spill response, incident investigation, etc. Reporting initiates the formal documentation process and supports the development of key learnings to prevent a reoccurrence.

3.1 INITIAL NOTIFICATIONS

The person observing and/or involved with the emergency situation is required to make the following initial notifications:

Call #1 – AECOM Site Supervisor or Site Safety Officer

Role	Person Assigned to Role	Contact No. Primary		Contact No. Alt.	
Primary Site Supervisor:	Mark Becker	D	1-973-883-8696	M	1-908-347-7234
If unavailable,	Sunil Samaroo	D	1-973-883-8534	-	n/a

Call #1 – AECOM Site Supervisor or Site Safety Officer

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Alternate Site Supervisor:			
If unavailable, Site Safety Officer:	Sunil Samaroo	D 1-973-883-8534	- n/a

Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone

Call #2 – DCS Americas Incident Reporting Hotline

1-800-348-5046

DIRECT TOLL-FREE	Hours of Operation: 24 Hours/Day; 7 Days/Week

For injuries and illnesses, you should be transferred by the hotline to the AECOM Occupational Nurse:

AECOM Occupational Nurse

1-512-419-5016

DIRECT TOLL-FREE	Hours of Operation: 24 Hours/Day; 7 Days/Week

Call #3 – Affected Employee's Direct Supervisor

Employees are encouraged to program their direct supervisor's phone numbers into their cell phone.

Call #4 – Vehicle Management or Insurance Provider *(Vehicle Motor Vehicle Accidents Only)*

Employees involved in motor vehicle accidents or who have discovered property damage caused to motor vehicles should call the appropriate party:

ARI Fleet Management *(Fleet vehicles only)*

1-800-422-7647

DIRECT TOLL-FREE	Hours of Operation: 24 Hours/Day; 7 Days/Week

Rental Company *(Rental vehicles only)*

Refer to your rental agreement for contact numbers and hours of operation

Personal Insurance Provider *(Personal vehicles used for business travel only)*

Refer to your personal insurance policy for contact numbers and hours of operation

3.2 PROJECT NOTIFICATIONS

The AECOM Site Supervisor is required to make the project notifications. If the AECOM Site Supervisor cannot be reached or is not capable of making the notifications, the notifications will be made by an alternate AECOM Site Supervisor or AECOM Site Safety Officer. In the event those individuals cannot be reached, the person observing and/or involved with the emergency situation is required to make the following project notifications.

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
AECOM Task Manager:	Mark Becker	D 1-973-883-8696	M 1-908-347-7234
If unavailable, AECOM Task Mgr. Alternate:	Akta Patel	D 1-973-883-8548	D 1-973-699-4234
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3 INTERNAL AND EXTERNAL INCIDENT CALL CHAIN NOTIFICATIONS

The AECOM Task Manager is required to initiate internal and external call chain, as appropriate. In the event the Task Manager and alternate Task Manager are unavailable, the person attempting to contact the AECOM Task Manager is required to initiate the following internal and external call chains, as appropriate:

3.3.1 AECOM Safety, Health and Environment (SH&E) Team

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
EBL / Client Account SH&E Mgr.:	Timothy J. Gilles, STS	M 312-833-5991	D 630-829-2736
If unavailable, REM East SH&E Manager:	Pete Wray, CSP	M 302-660-9178	D 302-318-2880
If unavailable, AME Environment SH&E Director:	Candice Johnson	M 416-407-9661	- n/a
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3.2 AECOM Operations / Client Account Team

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
BP Account Program Manager:	Dave Espy	D 978-905-2195	M 508-735-1462
If unavailable, AME BP Client Account Manager:	Michael Clark	M 713-417-7171	D 281-675-1727
If unavailable, REM Department Manager:	Jay Francisco	M 562-824-5401	D 562-213-4114
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3.3 Client/Host Facility Representatives

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Site/Host Facility Contact:	Alex Sands AJM realty	O 516-743-9118	M 516-554-4410
AND BP Project Manager:	Jim Smith	M 630-379-8879	D 832-619-3585
If unavailable, BP Operations Manager:	Ron Halsey	M 714-746-4227	D 562-512-1056
If unavailable,			

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
BP HSSE Advisor/Manager:	R.C. Strain	M 281-896-6470	
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3.4 Subcontractor and/or Third-Party Contacts

The following subcontractor(s) and/or third parties are involved with field activities at the site under a contractual relationship with AECOM, a contractual relationship with an AECOM subcontractor, or as part of a separate, but collaborative effort on behalf of the client.

For emergencies affecting subcontractors and/or third parties, the AECOM Task Manager is required to initiate subcontractor and/or third-party call chain, as appropriate. In the event the Task Manager and alternate Task Manager are unavailable, the person attempting to contact the AECOM Task Manager is required to initiate the following subcontractor and/or third-party call chains, as appropriate. If none of the emergency contacts can be reached, then the EBL/Client Account SH&E Manager or DCSA Area Manager must be notified.

3.3.4.1 Cascade Technical Services

Select One: ☒ AECOM SUB ☐ SUB OF AECOM SUB ☐ CLIENT DIRECT HIRE SUB ☐ THIRD PARTY

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Primary Contact Person:	John Diamond	M 516-729-5058	O 516-596-6300
If unavailable, Alternate Contact Person #1:	Charles Green	M 917-862-0578	O 516-596-6300
If unavailable, Alternate Contact Person #2:	None	- n/a	- n/a
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3.4.2 CorBuilt, LLC

Select One: ☒ AECOM SUB ☐ SUB OF AECOM SUB ☐ CLIENT DIRECT HIRE SUB ☐ THIRD PARTY

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Primary Contact Person:	A.J. Cholakis	M 860-415-8487	- n/a
If unavailable, Alternate Contact Person #1:	Rich Cormier	M 860-608-5108	- n/a
If unavailable, Alternate Contact Person #2:	None	- n/a	- n/a
Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone			

3.3.4.3 Maser Consulting

Select One: ☒ AECOM SUB ☐ SUB OF AECOM SUB ☐ CLIENT DIRECT HIRE SUB ☐ THIRD PARTY

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Primary Contact Person:	Lucas Boyer	M 518-807-6175	- n/a
If unavailable,			

Select One: ☒ AECOM SUB ☐ SUB OF AECOM SUB ☐ CLIENT DIRECT HIRE SUB ☐ THIRD PARTY

Role	Person Assigned to Role	Contact No. Primary	Contact No. Alt.
Alternate Contact Person #1:	Dwayne Cooper	M 518-588-3084	- n/a
If unavailable, Alternate Contact Person #2:	None	- n/a	- n/a

Note: D = Direct Office Phone; M = Mobile Phone, O = Office Phone, R = Radio, and S = Satellite Phone

3.4 INTERNAL REPORTING

3.4.1 Incident and Near Miss Reporting

All incidents and near misses (i.e. incidents without consequences), regardless of type and perceived severity, must be reported within IndustrySafe (AECOM's SH&E Database) within the timeframes listed below:

Incident Type	IndustrySafe Reporting Timeframe
Significant Incident, including any injury to an AECOM employee or Subcontractor	Within 4 hours
All Other Incidents	Within 24 Hours

Note: Only the basic facts, who, what, when, where and how, are needed to complete the initial IndustrySafe report. SH&E Managers will assist you in updating the report as additional information becomes available.

Significant incidents include:

- Fatality;
- Amputation;
- Hospitalization for treatment for more than 24 hours (admission);
- Any single event resulting in more than one employee requiring medical treatment or more than one employee being away from work for more than 3 days;
- Any SH&E-related Consent Agreement/Order/Lawsuit or enforcement action seeking more than $10,000 or alleging criminal activity;
- Any spill or release of a hazardous material that is reportable to a regulatory agency;
- Any Notices of Violation resulting from not operating within a regulatory agency permit/license or consent;
- Any incident resulting in property damage expected to exceed $10,000 United States dollars (USD);
- Any security-related incident that could have caused significant harm to an AECOM employee; and/or
- Any near miss event that may have resulted in any of the above consequences, but because of "luck" did not result in harm to persons, property or the environment.

Other incidents include:

- Any injury or illness to an AECOM employee or subcontractor, even if it does not require medical attention, including non-work-related injuries/illnesses that have become significantly aggravated by the work environment;
- An injury to a member of the public or client representative occurring on an AECOM-controlled work site;
- Re-occurring conditions such as back pain or cumulative trauma disorders (e.g., carpal tunnel syndrome);
- Fire, explosion or flash that is not an intended result of a planned event (e.g., remediation process, laboratory procedure);
- Any incident involving company-owned, rented or leased vehicles (including personal vehicles used for company business); and/or
- Any failure to comply with requirements of a regulatory permit issued to AECOM.

3.4.2 Safety Observation Reporting

All safety observations must be reported within IndustrySafe in a timely manner. It is recommended that safety observations are reported within 7 to 14 days of the observation.

3.4.3 SH&E Database Access

Incidents, near misses, audits/inspections and safety observations must be entered into IndustrySafe, which is one of AECOM's SH&E Databases. IndustrySafe can be accessed via the SH&E Page on Ecosystem when you are in the office or connected to the AECOM network via VPN. IndustrySafe may also be accessed from your smartphone/device, if equipped with a QR Code Reader App, using the QR Code to the right.

IndustrySafe

↑ Incidents, Near Misses, Audits/Inspections and Safety Observations ↑

3.4.4 Reporting Assistance

If your field schedule, access to internet, and/or limited cellular phone coverage have the potential to impact timely incident, near miss, and/or safety observation reporting, please contact your AECOM Task Manager and/or SH&E Manager for assistance.

3.5 CLIENT REQUIRED REPORTING

Under the IPO contract, formal reporting of incidents and near misses in BP's Health, Safety, Security and Environment (HSSE) database is not required. However, the AECOM Program Manager or designee is responsible to provide verbal notification to the appropriate BP contact person in a timely manner.

4.0 REASONABLY CREDIBLE EMERGENCY SCENARIOS

Based on site history, operations, and setting along with the approved scope of work, the following emergency scenarios have been determined to be reasonably credible to occur. Immediate actions and post-emergency follow-up actions, when applicable, are discussed below for each reasonably credible emergency scenario.

4.1 INJURIES AND ILLNESSES

4.1.1 Immediate Actions

4.1.1.1 Engage Medical Resources

In the event of a life-threatening or critical emergency, AECOM employees should dial 911 or the site-specific number for the emergency responder and follow the recommended instructions. After dialing 911 or the site-specific number and in less serious situations, an injured employee or a co-worker should contact the Incident Hotline at 1-800-348-5046 to ensure that the employee receives the best care at the best time (i.e., within the first hour following an injury or potential injury). By contacting the Incident Hotline, the worker can be connected with AECOM's nurses for first aid advice. If recommended by the nurse, the supervisor or a co-worker should drive the injured employee to the project-designated clinic or hospital.

4.1.1.2 Care for the Injured or Ill Person(s)

Employees trained in first aid, CPR and/or Automated External Defibrillators (AED) should render initial care in a manner consistent with their training. This care should be provided until the injury or illness is resolved (i.e. first aid cases) or transportation to the appropriate medical facility is arranged and present on the site (i.e. treatment beyond first aid incidents).

First Aid, CPR and AED Trained Personnel

Name	Company	Contact No.	1st Aid	CPR	AED
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

4.1.1.3 Transport to Nearest Medical Facility for Treatment

For injuries and illnesses that require treatment beyond first aid, the injured/ill person(s) shall be transported to the nearest medical facility for treatment. For life-threatening or critical emergencies, Emergency Medical Services (EMS) should handle the transport. EMS will determine the hospital to which the injured/ill person(s) will be transported. The AECOM Field Supervisor and/or Site Safety Officer shall confirm with EMS the final destination of the injured/ill persons. The nearest hospital equipped for emergency medical care, driving directions and map are provided below.

For less serious situations, the AECOM Site Supervisor, AECOM Site Safety Officer (SSO) and/or their designee shall transport and accompany the injured/ill person(s) to the nearest Occupational Clinic (preferred) or hospital, if an occupational clinic is not available, not within a reasonable driving distance or cannot be reached during their hours of operation. The nearest occupational clinic, driving directions and map are provided below.

Nearest Hospital

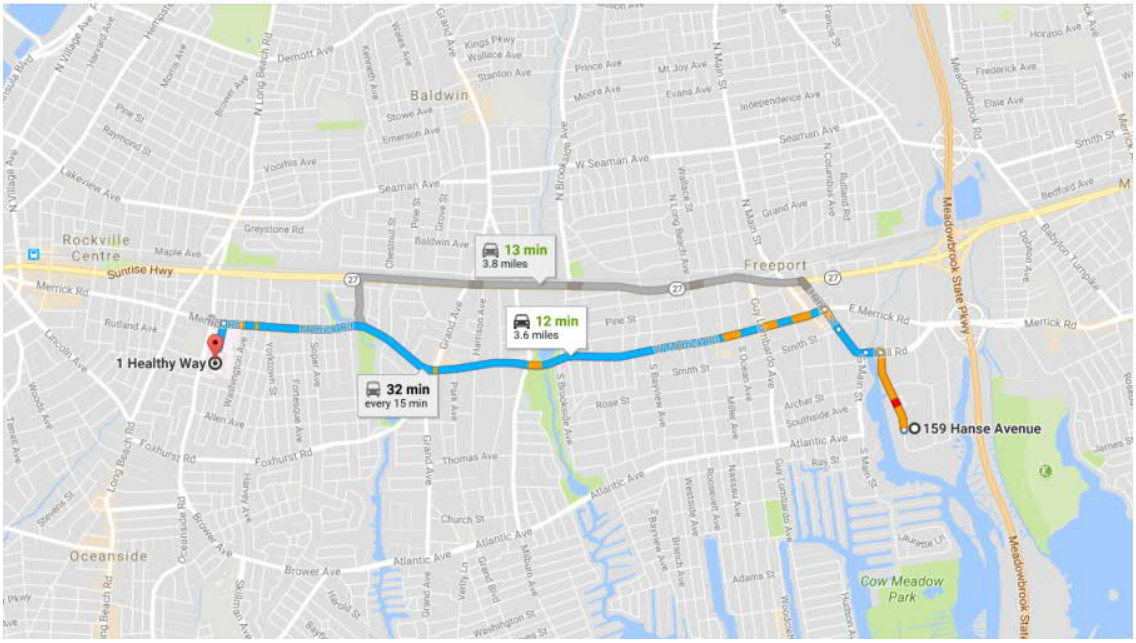
South Nassau Communities Hospital.....**1-516-632-3000**

Address:	One Healthy Way		
City:	Oceanside		
State/Province:	New York	Postal/Zip Code:	11572
Estimated Travel Time:	12 Minutes	Distance:	3.6 Miles

DRIVING DIRECTION

- From Site, head north on Hanse Ave toward Rider Pl
- Turn left onto Mill Road
- Slight right onto S Main St
- Continue onto Henry Street
- Turn left onto E Merrick Rd
- Turn left onto Healthy Way/Mount Ave/One healthy Way

MAP TO HOSPITAL



Nearest Occupational Clinic

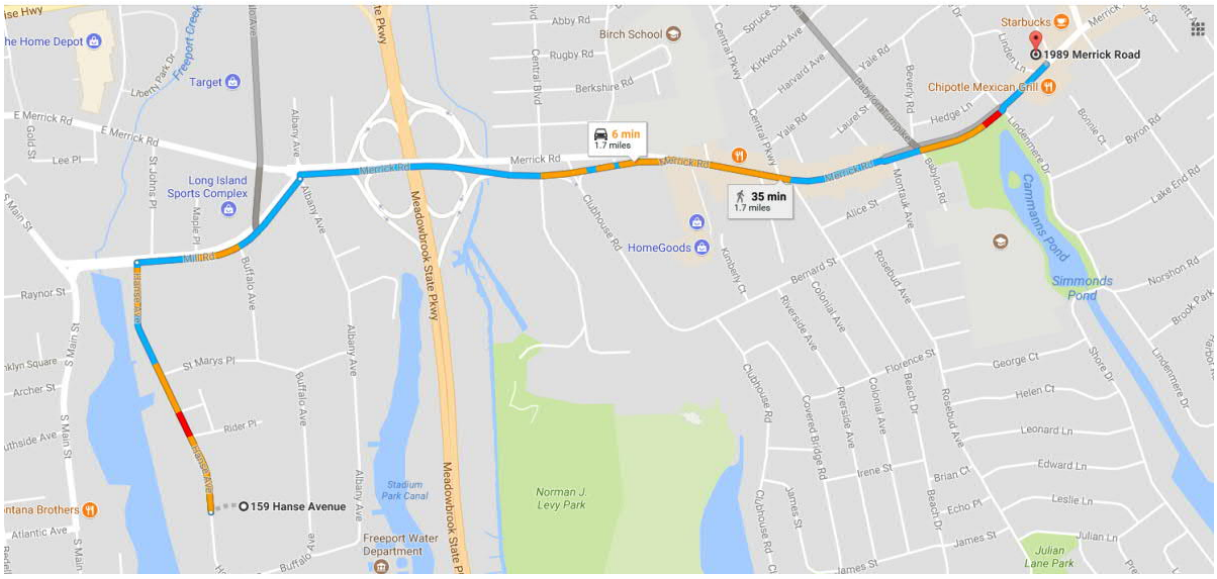
City MD Urgent Care **1-516-584-4448**

Address:	1989 Merrick Road		
City:	Merrick		
State/Province:	New York	Postal/Zip Code:	11566
Estimated Travel Time:	6 Minutes	Distance:	1.7 Miles
Hours of Operation:	M-F: 8am - 8pm; Sat & Sun: 8am – 5pm		

DRIVING DIRECTION

- From Site, head north on Hanse Ave toward Rider Pl
- Turn right onto Mill Rd
- Slight right onto E Merrick Road
- Destination will be on the left

MAP TO OCCUPATIONAL CLINIC



4.1.1.4 Engage AECOM Occupational Nurse with Medical Treatment Provider

The AECOM Site Supervisor, AECOM SSO or their designee who is accompanying the injured/ill person(s) to the medical treatment facility shall notify the AECOM Occupational Nurse of the situation, communicate the destination of the injured/ill person(s) and assist the nurse in connecting with the medical treatment provider to facilitate medical case management.

4.1.2 Follow-Up Actions

Outside of notifications and reporting, the AECOM Site Supervisor, AECOM SSO or their designee shall coordinate the post-treatment transportation of injured/ill person(s).

4.2 MOTOR VEHICLE BREAKDOWNS AND FLAT TIRES

4.2.1 Immediate Actions

If safe to do so, remove the car from the traveled way. To the extent possible, AECOM personnel should not change flat tires or perform similar repairs.

- For rental vehicles, contact the rental company
- For fleet vehicles, contact ARI Fleet Management: 1-800-422-7647
    - Prompt 1 – Roadside Assistance
    - Prompt 3 – Maintenance Management
- For personal vehicles used on AECOM business, contact an emergency provider.

4.3 MOTOR VEHICLE COLLISIONS

All vehicles should be rented through TripActions™ (accessible via Ecosystem) to ensure that AECOM insurance is included in the rental rate. All other insurances should be declined. AECOM's rental vehicle insurance policy for National/Enterprise or Avis can be found on the DCS Americas United States or Canada travel pages. Drivers MUST print and carry the applicable insurance policy for the rental. For company owned vehicles, drivers MUST also print and carry proof of insurance.

4.3.1 Immediate Actions (Recommended Responses)

- Assess the situation and move all occupants (except the injured) out of further harm's way.
- If safe to do so, remove the car from the traveled way.
- Call 911, if necessary
    - If appropriate, wait for police to arrive before moving vehicles.
- Provide insurance information to other drivers if necessary or requested and collect the same:
    - Driver's Information:
        - Name and contact number
        - Driver's license number, expiration date and issuing state/province
        - Insurance policy number, carrier/provider and provider's contact number
    - Vehicle Information:
        - Make, model and year
        - License plate/tag number and issuing state/province

    - Owner's name, address and contact number
  - Passenger's Information:
    - Name and contact number
  - Witness Information:
    - Name and contact number

- If possible, obtain names and phone numbers of witnesses.
- Sketch the accident scene and/or take photographs of the scene, if possible and safe to do so.
- Take photographs of the damage to vehicles and property, if possible and safe to do so.
- If police are not on scene, file an accident report at the local police station.

NOTE: DO NOT ADMIT LIABILITY, AGREE TO PAY FOR DAMAGE, OR SIGN A DOCUMENT RELATED TO AN INCIDENT EXCEPT AS REQUIRED BY LAW.

4.3.2 Follow Up Actions

4.3.2.1 Police Report

- If the police were not on scene, file an accident report at the local police station.
- Include a copy of the police report with the IndustrySafe report (upload report to IndustrySafe).

4.3.2.2 Drug and Alcohol (D&A) Testing

Driver's involved in at-fault motor vehicle collisions or collisions resulting in $2,500 U.S. Dollars (USD) or more in damage to individuals, vehicles and/or property shall undergo drug and alcohol testing. The AECOM Site Supervisor, AECOM SSO or designee shall:

- Contact Lindsay Scammell at 1-804-515-8552 to coordinate the drug and alcohol testing;
- Accompany and transport the driver to and from the D&A testing facility; and
- Coordinate transportation for the driver pending the results of the D&A testing.

4.4 MOTOR VEHICLE VANDALISM AND THEFT

4.4.1 Immediate Actions

- Take photographs of the damage to vehicles and property, if possible and safe to do so.
- Contact local law enforcement and file a report

4.4.2 Follow Up Action

- If the police were not on scene, file an accident report at the local police station.
- Include a copy of the police report with the IndustrySafe report (upload report to IndustrySafe).

4.5 ENVIRONMENTAL SPILLS/RELEASES

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

4.5.1 Immediate Actions – Reportable Quantity Regulatory Agency Notifications

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

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

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

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

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

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

4.5.2 Immediate Actions – Spill Evaluation and Responses

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

The procedures of the Emergency Response section of this HASP are immediately implemented when the spill is determined to require emergency precautions and action, if necessary, to protect those outside the clean-up area, notification of the appropriate authorities is made. Table 4.5.1 lists the spill conditions that trigger notification of Federal, state, and local agencies.

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

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

4.5.3 Follow Up Actions – Post Spill Evaluation

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

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

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

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

4.6 FIRE

4.6.1 Immediate Actions

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

- The fire must be small (i.e., smaller than a trash can) and in its early stages
- The employee must have an escape route
- The employee must be trained and know they have the right type of extinguisher
- The employee must be safe from toxic gases
- There must be no hazardous conditions that could quickly accelerate the fire (i.e., presence of chemicals, especially dry grass, etc.)

Above all, if in doubt, the employee must not attempt to fight the fire.

4.7 ENVIRONMENTAL IMPACTS

AECOM strives to avoid or control environmental impacts from our operations through planning and implementation of best practices as well as preparing responses to react to environmental incidents. Environmental Compliance procedure S3AMM-204-PR provides details on permitting and planning requirements.

Potential Environmental Impacts

	Type	Description of Hazard and Permit or Control Being Implemented
☐	Air Emissions	[Describe any operations where air emissions may negatively impact surrounding environment, air emissions permit(s), etc. and discuss associated control(s)]
☒	Hazardous Waste Management	If hazardous, solid, and/or municipal wastes are generated during any phase of the project, the waste shall be accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations.
☐	Storm Water Pollution	[Describe any operations that may generate/discharge storm water from the project site, NPDES/general construction storm water permit(s), etc. for the project site]
☐	Wetlands	[Describe any wetlands– Use the FWS online wetland mapper (http://www.fws.gov/wetlands/Data/mapper.html) to determine if any wetlands exist on, adjacent or in close enough proximity to the project

Potential Environmental Impacts

	Type	Description of Hazard and Permit or Control Being Implemented
		site to be negatively impacted by site operations along with any permit(s) and controls]
☐	Critical Habitat(s)	[Describe and critical habitats – Use the FWS online critical habitat mapper tool (http://criticalhabitat.fws.gov/) to determine if any plant or animal exists on, adjacent to, or may otherwise be impacted by your project along with any regulatory permit(s) and control measures]
☐	Other (specify)	[Describe any additional potential environmental impacts and their control measures]

4.7.1 Immediate Action(s)

AECOM will take the appropriate steps to mitigate environmental impacts by implementing the controls listed above and addressing any spills or fires as outlined in ERP sections 4.5 and 4.6, respectively.

4.8 INCLEMENT WEATHER

Inclement weather includes but is not limited to heavy rain or storms and associated floods, heavy winds, lightning, snow storms and blizzards, and sand storms and haboobs. Weather conditions which are normal or expected can nonetheless hazards, such as cold weather in winter or excessive heat in the summer. The best approach to preventing exposure to these hazards is project planning. Where possible, plan to perform work at seasonably appropriate times of the year. Starting several days to a week prior to field work, begin reviewing projected weather forecasts to determine if work should be delayed, or accelerated, to avoid days with higher chances of inclement weather. Weather conditions can change rapidly, however, and field personnel and the Task Managers should be prepared to utilize Stop Work Authority if uncontrolled hazardous situations develop.

Additional precautionary measures for reasonably foreseeable weather conditions are provided below

4.8.1 Ambient Temperature (Heat or Cold)

Heat and cold stress may vary based upon work activities, PPE/clothing selection, geographical locations, and weather conditions. Where possible, plan work to avoid the hottest (or coldest) part of the day. To reduce the potential of developing heat/cold stress, be aware of the signs and symptoms of heat/cold stress and watch fellow employees for signs of heat/cold stress. Use vehicles or covered area for shelter and take breaks as needed in hot weather keep hydrated, prevent over exposure to the sun with clothing or use of sun cream and take frequent breaks out of the sun. Use the "buddy system" to monitor effects of heat stress as it can be difficult to identify the impacts of heat in yourself. Create shaded work areas if appropriate. Use a strong sunscreen and wear a full-brimmed hat when in the sun to protect the back of the neck and shoulders. Refer to SH&E Procedure S3AM-113-PR1, Heat Stress, for more information.

In cold/wet weather, be aware of potentially slippery surfaces (wet or icy). Wear boots with good tread and carefully select your walking path to eliminate or reduce the need to traverse wet or icy surfaces. Wear warm / waterproof clothing and take breaks in a warm location. If heavy snows or icy weather are anticipated, consider your driving route prior to leaving for the site or returning at the end of the day. It may be necessary to stop work earlier in the day to allow time to return to lodging if road conditions are at risk of deteriorating. Refer to SH&E Procedure S3AM-112-PR1, Cold Stress, for more information

4.8.2 Storms

Heavy or unexpected storms, whether they be rain, snow, or wind, represent a changed condition in which multiple hazards could be present. Stormy weather increases hazards at the job site by making travel more treacherous, both on foot and in vehicles. Visibility can be reduced. Manual tasks become more difficult as conditions worsen, increasing the chances of injury. Mental states may deteriorate increase the risks of hazards attributable to frustration or exhaustion. Other hazards may exist; for example, winds could cause objects to blow away or strike workers or equipment or blow dust or debris into eyes. For these reasons, be aware of changing weather conditions and be prepared to stop-work to secure the project site and depart prior to storms whenever possible. If storms suddenly develop, remember that the loss of equipment or materials is far preferable to taking risks of injury by attempting to demobilize when storms are active.

The AECOM Site Supervisor and/or AECOM Site Safety Officer shall monitor weather using two or more of the following: visual observation, weather radio, AM/FM radio, smart phone app, site weather stations (if available), and internet.

4.8.2.1 Immediate Actions – Watch Issued

Field teams will be instructed to be prepared to cease activities and secure the work area when a severe weather watch is issued by the local weather service.

4.8.2.2 Immediate Actions – Warning Issued

Field teams will be instructed to immediately cease activities and seek shelter when a severe weather warning is issued by the local weather service or visual observation indicates an imminent weather threat. The shutdown shall remain in effect until the severe weather warning is lifted/expires or visual observation indicates the severe weather has passed.

4.8.2.3 Follow Up Actions

Following any severe weather event, the work areas shall be inspected by the AECOM Site Supervisor and/or AECOM SSO. If it is determined that site conditions will not allow scheduled tasks to be safely performed, site activities will be postponed pending improved site conditions. If it is determined that site conditions will allow scheduled tasks to be safely performed. the Task Hazard Assessment (THA) shall be reviewed and updated by the field crew to reflect and mitigate any new site hazards.

4.8.3 Lightning

One of the most serious weather threats is lightning. A two-tier notification system consisting of alerts and stand downs shall be used to allow ample time for field teams to cease their activities, secure the work area, and seek shelter.

4.8.3.1 Immediate Actions – Alerts and Stand Downs

Alerts are issued by AECOM Site Supervisor and/or AECOM Site Safety Office when inclement weather, including lightning is detected within 50 miles (80 km) of the site. Alerts indicate that work crews should be prepared to cease all field activities and secure the work area. Stand Downs are issued by AECOM Site Supervisor and/or AECOM Site Safety Officer when inclement weather is detected within 30 miles (50 km) of the work area. Stand downs indicate that all work crews shall immediately cease all field activities and seek shelter. Stand downs remain in effect until the inclement weather has passed. For thunderstorms, the stand down will remain in effect for a minimum of 30 minutes following the last detection of lightning.

4.8.3.2 Immediate Actions - Guidance for Lightning

Go Indoors: Remember the phrase, "When thunder roars, go indoors." If you see lightning and cannot count to 30 before hearing thunder, the lightning is too close for comfort. Find a safe, enclosed shelter when you hear thunder. Safe shelters include homes, offices, shopping centers, and hard-top vehicles with the windows rolled up.

Crouch Close to the Ground and Separate: If you are caught in an open area, crouch down in a ball-like position (feet and knees together) with your head tucked and hands over your ears so that you are down low with minimal contact with the ground. Do NOT lie down. Lightning causes electric currents along the top of the ground that can be deadly over 100 feet away. Crouching down is the best combination of being low and touching the ground as little as possible.

Separate: If you are in a group during a thunderstorm, separate from each other. This separation will reduce the number of injuries if lightning strikes the ground.

If a person is struck by lightning:

- Call 911 or other Emergency Services Contact.
- Assess the scene to ensure that continuing risk to rescuers does not exist if lightning strikes. For other electrical-related emergencies (non-lightning), ensure the source of electricity has been deenergized.
- Check to see if the victim is breathing and proceed with CPR if victim is not breathing

4.9 FITNESS FOR DUTY AND ILLNESS REPORTING DURING PANDEMIC

4.9.1 Immediate Action(s)

AECOM employees should always live our life-preserving principle of "Fitness for Duty", which requires employees to stay home from work when they are sick, as they are not "Fit for Duty" when ill. During times of pandemic, the importance of this step is increased. If you experience signs/symptoms of illness (see images below) or find out that you have come into contact with a person who has been confirmed positive with the Coronavirus, notify the site supervisor and the project manager, your Area, Regional, or Business Line SH&E Manager, and go home and/or stay home. Notify the AECOM Incident Reporting Hotline (1-800-348-5046) and/or the AECOM Nurse Line (1-512-419-5016). Managers will work with the local SH&E and/or Resiliency teams to respond according to the AECOM Pandemic Procedure: SR1-003-PR2.

 **FEVER**	 **TIREDNESS, CONFUSION**	 **DRY COUGH**	 **SHORTNESS OF BREATH**
 **NASAL CONGESTION, SORE THROAT OR RUNNY NOSE**	 **BLUE LIPS OR FACE**	 **PERSISENT PAIN OR PRESSURE IN THE CHEST**	 **IF ANY OF THESE SYMPTOMS ARE IDENTIFIED, SEEK MEDICAL ATTENTION!**

4.9.2 Follow Up Actions

Employees exhibiting signs/symptoms following close contact with a suspected or positive case or following visit to a location of a positive or confirmed case, need a doctor's release to return to work following their recovery. Employee that are a suspected or positive case, also need a doctor's release to return to work following their recovery.

HEALTH AND SAFETY PLAN (HASP)

Note: This document is intended to provide key health and safety information and must be accompanied by the Site Emergency Response Plan (ERP).

1.0 INTRODUCTION

This written HASP is designed to identify, evaluate, and control safety and health hazards, and to outline emergency response actions for AECOM-managed activities. This HASP must be kept on site during wok activities and made available to all workers including subcontractors and other site occupants for informational purposes. AECOM subcontractors are expected to independently characterize, assess, and control site hazards created by their specific scope of work.

This section of the HASP summarizes important AECOM SH&E Procedures that apply to all Design and Consulting Services (DCS) Americas jobs. See Attachment B for complete copies of applicable field SH&E Procedures. This template has been designed primarily for use in the United States; see procedure attachment S3AM-320-ATT2 for Canadian Specific Requirements on AECOM's ecosystem.

1.1 APPLICABLE REFERENCES

This Health and Safety Plan (HASP) conforms to the regulatory requirements and guidelines established in the following documents:

- Federal Occupational Safety and Health Administration (OSHA) Code of Federal Regulation Title 29, Part 1910 (29 CFR Part 1910), Safety and Health Regulations for General Industry and 29 CFR 1926, Safety and Health Regulations for Construction.
- Title 8 of the California Code of Regulations (8 CCR), with special attention to Section 5192 Hazardous Waste Operations and Emergency Response, and Section 3202, Injury Illness Prevention Program and to Sub Chapter 4, Sections 1500 - 1938 Construction Safety Orders.
- National Institute for Occupational Safety and Health/Occupational Safety and Hazards Administration/U.S. Coast Guard/U.S. Environmental Protection Agency, Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, Publication No. 85-115, 1985.
- The requirements in this HASP also conform to AECOM's Safety for Life Program requirements as specified in the AECOM Safety, Health and Environment (SH&E) Manual.
- BP's Golden Rules of Safety (Attachment H)

Project Assumptions

- The site is controlled by the Illinois Tool Works and AECOM is responsibility for controlling our immediate work area only.
- Site management will assist in locating subsurface utilities, vessels, and structures located on the property and outside the scope of the utility locator service.
- No confined spaces will be entered on this project.
- No excavations will be entered.

- Work will be performed during daylight hours.

2.0 SITE INFORMATION AND SCOPE OF WORK

2.1 SITE DESCRIPTION

The site (IPO US NY Columbia Cement), which is currently vacant and inactive, is located at159 Hanse Avenue in Freeport, New York (postal code 11520) in a busy, light industrial area. The site's latitude and longitude is 40.647100, -73.571384.

A waste transfer facility is located immediately north of the site. A former electronics components manufacturer is located immediately east of the site. To the south is a wine and liquor distributor. Hanse Avenue borders the site to the west. This is a very busy road with a great deal of truck traffic. Freeport Creek is located 500 feet west of the site and Stadium Park Canal is 1,000 feet east of the site. Stadium Park Canal merges with Freeport Creek approximately 1,500 feet southeast of the site. From this point, surface water flows south through tidal marshes to the Atlantic Ocean, approximately 5 miles south of the site. Storm water drains at the site discharge to Freeport Creek.

2.2 SITE BACKGROUND/HISTORY

The Columbia Cement Company, which was owned by Burmah Castrol, produced adhesives for a variety of applications. In 1988, while Columbia Cement operated the facility, approximately 1,760 gallons of 1,1,1-trichloroethane (1,1,1-TCA) was released to a storm drain during filling of an underground storage tank (UST) due to a failure of a contractor's tanker truck. The soil and groundwater at the site are presently impacted with 1,1,1-TCA and breakdown products, including 1,1-dichloroethane and chloroethane. Tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, vinyl chloride, methylene chloride and other VOCs also have been detected on site. The on-site facility is currently inactive and vacant. Prior to development the area was part of a municipal landfill, so there is a potential for methane to be present is soil and/or sub/slab vapor.

2.3 CLIENT OR THIRD-PARTY OPERATIONS AT SITE

The on-site facility is currently inactive and vacant.

2.4 SCOPE OF WORK

2.4.1 Project Scope and Objectives

Monitoring Well Installation

To monitor groundwater conditions during remedial activities, monitoring wells may be installed in various locations in and around the Site. Wells will be installed using hollow stem auger methods. Soils will be screened with a calibrated photoionization detector (PID) and logged by an AECOM geologist.

In each well a sand pack will be placed in the annular space from the bottom of the well to 1 foot above the top of the well screen. A bentonite seal will be placed above the sand pack. The seal will be at least 2 feet thick. A cement-bentonite grout will be placed from the top of the bentonite seal to approximately 3 feet below grade. Each well will be finished with a flush-mount steel cover set in concrete, and a water-tight locking cap. After installation, each well will be developed by purging with a submersible pump until visibly clear of sediment. The monitoring wells will be surveyed by a licensed land surveyor.

Vapor Intrusion Sampling

Vapor intrusion sampling includes the collection of sub-slab vapor and indoor air samples. Vapor intrusion samples will be collected in Summa canisters. Sub-slab vapor samples will be collected by drilling a hole through a floor slab using an electric hammer-drill with a ¾-inch bit. The hole will be screened with a calibrated PID. Tubing will be inserted into the hole and connected to the Summa canister and the annular space will be sealed with clay. A leak test will be conducted using a helium shroud. Indoor air samples will be collected by opening the Summa canister.

Soil Sampling

At various times during the investigation/remediation, soil samples may be collected using direct push methods. Soil borings will be cleared to a depth of 5 feet by either hand auger or air knife. Soil samples will be collected in 5-foot long macro-core samplers. Soils will be screened with a calibrated PID and logged by an AECOM geologist. At completion borings will be grouted with bentonite and topped with concrete. Soil samples may also be collected during monitoring well installation. Samples will be collected through the hollow-stem augers using a split spoon. Soils will be screened and logged with the macro-core sampler.

Groundwater Sampling

AECOM will perform semi-annual sampling of selected monitoring wells. Also, to monitor performance of ISCO injections AECOM will collect groundwater samples from Site monitoring wells before and after the injections. AECOM will stage the necessary equipment and sample containers and mobilize from the office to the Site. Before sampling, AECOM will don the appropriate PPE, inspect the work area and note any changes since the last site visit. AECOM will establish a safe work zone around the well(s) to be sampled. Each well will be opened and the headspace within the well casing will be screened with a calibrated PID. The depth to water and total well depth will be gauged with an electronic water level indicator. Sample tubing will be inserted into the well to the desired depth and connected to a peristaltic pump and water quality meter with a flow-through cell. Sample tubing will be cut using only a non-fixed blade knife. The well will be purged with the peristaltic pump and the water will be contained in a 5-gallon bucket. Periodic readings will be made with the water quality meter. When the readings stabilize, the sample will be collected. Sample containers will be filled from the pump discharge and stored on ice. After sampling is completed, the well will be closed, and the purge water will be transferred from the bucket to a drum for storage pending off-site disposition. The water level indicator and water quality meter will be decontaminated using non-phosphate detergent and distilled water. Sample tubing, gloves and other IDW will be placed in garbage bags for subsequent disposal. Samples and equipment will be packed, and AECOM will demobilize to the office.

ISCO Injection

The ISCO injection materials will be a mixture of sodium persulfate and sodium hydroxide. The sodium persulfate is provided as a powder in 55-lb. bags. Safety data sheets (SDSs) for these products are presented in Attachment B. The sodium hydroxide will be a 25% solution provided in 55-gallon drums or in 300-gallon totes. All tanks, piping, hoses, fittings and materials that will contact the ISCO chemical will be constructed of compatible materials. The sodium hydroxide will be pumped into a 1,050-gallon mixing tank using a diaphragm pump and diluted. The sodium persulfate will be added and the mixed into solution using an electric mixer. The ISCO material will be injected into permanent injection points using a diaphragm pump. The material will be injected at low pressure to avoid “daylighting” of chemical. After injections, all equipment will be thoroughly cleaned.

ISCO amendments may also be delivered via soil mixing or in-situ stabilization (ISS). For ISS, the pavement and top five feet of soil will be removed from the treatment area(s). Chemicals will be added to the excavation and will be mixed with the soil using the excavator bucket through the treatment interval. After the mixing, the excavation will be backfilled and repaved.

Vapor Monitoring

In addition to the air monitoring for Site worker health & safety (Section 6.6), additional air monitoring will be performed to provide a measure of protection for the downwind community (i.e., off-site receptors including

residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The Community Air Monitoring Plan (CAMP) is provided in the applicable project Work Plan.

The injection of sodium persulfate and sodium hydroxide could result in the generation of soil vapor. The oxidation of organic material may produce carbon dioxide that could migrate to the unsaturated zone. Methane associated with the landfill material and other VOCs may be liberated with the carbon dioxide. In addition to the CAMP monitoring, to assess vapor generation, vapor monitoring will be conducted in selected soil gas points during the ISCO injections. Soil vapor points SG-05-06, SG-05-07 and SG-09-12 will be utilized for vapor monitoring. Points SG-05-06 and SG-05-07 are located in the driveway east and west of the injection area, respectively. Point SG-09-12 was installed in the driveway in the injection area prior to the combined Enhanced Bioremediation and ISCO Pilot Test. Vapors will also be monitored in the storm drain located in the loading dock area and any other storm drains located along Hanse Avenue in front of the Site building. These points will be monitored using a photoionization detector (PID) and a landfill gas meter, capable of detecting oxygen, methane and carbon dioxide. During the injection program, a reading will be taken at these 4 points at the start of each day prior to the start of injections. Readings will also be made hourly while the injections are occurring. If elevated readings of methane, CO2, carbon monoxide or other VOCs are detected in soil vapor points and/or storm drains, vapor readings will also be collected in the workers breathing zone directly above these locations. Refer to Section 6.3 (Monitoring) of this HASP for additional information regarding action levels. Each day, a final reading will be made at all 6 points at least one hour after the cessation of injections for that day. The readings will be recorded in a log book. Specific monitoring requirements and action levels are provided in the CAMP.

Sub-Slab Depressurization System (SSDS) Installation

The installation of the SSD systems will comprise the following:

- Preliminary site walk
- Contact DigSafe NY and conduct a geophysical survey to locate any potential buried utilities or structures
- Crews will core 5-inch diameter holes and/or cut 6-inch wide trenches through concrete floor slabs, at which point PVC piping will be installed into the hole and routed outside to a skid-mounted centrifugal blower installed outside the building.
- A NYS licensed electrical subcontractor will connect power to the blower.
- Concrete pads will be poured and allowed to cure.
- The centrifugal blowers will be installed inside an equipment enclosure on the concrete pads.
- The void space in the floor around the floor penetrations will be backfilled with clean stone and the surface restored with concrete.
- System startup and testing will be performed, which includes drilling approximately 5/8-inch holes in the concrete floors at various locations; installation of temporary manometers to collect pressure readings, and then sealing of the holes with hydraulic cement.
- Periodic indoor air monitoring will be conducted by installing summa canisters to collect air samples.
- Periodic operation and maintenance of the SSD systems.

Groundwater Level Monitoring

- AECOM will perform groundwater level monitoring in selected monitoring wells in OU-1 and OU-2 and in Freeport Creek. AECOM will don the appropriate PPE and will establish a safe work zone around the well(s) to be monitored. Each well will be opened and the headspace within the well casing will be screened with a calibrated PID. The depth to water and total well depth will be gauged with an electronic water level indicator. A pressure transducer will be attached to nylon string and secured approximately five feet below the groundwater interface. Using a hand-held device, the pressure transducer will be programmed to record water levels at 15-minute intervals and the monitoring will be initiated. The well cover will be replaced to protect the well during the monitoring period. A pressure transducer will also be installed in Freeport Creek, A piece of PVC pipe will be secured to the bulkhead of the creek and the pressure transducer will be secured inside the PVC pipe. When the monitoring period is over, the transducers will be removed from the wells and the bulkhead. The PVC pipe will be removed from the bulkhead and the well covers will be replaced.

2.4.2 Risk Register

The following tasks will be performed to achieve the project objective(s). A Task Hazard Assessment (THA) for each operation being performed by AECOM must be included in Attachment C, while those performed by managed subcontractors should be prepared by the subcontractor. Oversight of managed subcontractor activities is considered a discrete AECOM task, and should be listed below.

Task Name	Permit(s) Required		Task Performed by		
			AECOM	SUB	Third-Party
Coronavirus Precautions – Field & Field Office	☐ Yes	☒ No	☒	☐	☐
Coronavirus Travel Precautions	☐ Yes	☒ No	☒	☐	☐
Coronavirus Vehicle Cleaning	☐ Yes	☒ No	☒	☐	☐
Coronavirus Ground Travel	☐ Yes	☒ No	☒	☐	☐
Coronavirus Air Travel	☐ Yes	☒ No	☒	☐	☐
Aerial Lift Operations	☐ Yes	☒ No	☐	☒	☐
Concrete Cutting	☐ Yes	☒ No	☐	☒	☐
Geoprobe	☐ Yes	☒ No	☐	☒	☐
PVC Pipe and Transducer Installation	☐ Yes	☒ No	☐	☒	☐
Gauging Groundwater Monitoring Wells	☐ Yes	☒ No	☒	☐	☐
ISCO Injection	☐ Yes	☐ No	☐	☒	☐
	☐ Yes	☐ No	☐	☐	☐

2.4.3 Scope of Work Risk Assessment

☐	Low Risk:	Examples: Non-intrusive work, occasional exposure and/or low risk hazards
☐	Medium Risk:	Examples: Intrusive work, heavy equipment use, frequent exposure and/or moderate hazards
☒	High Risk:	Examples: Complicated scope, large/multiple work crews, and/or constant exposure to hazards

In general, the following tasks are considered High Potential (HiPo) tasks (also identified in S3AM-209-PR1, Risk Assessment). Depending upon the factors contributing to the severity and probability assessment of a hazard associated with a particular task, other HiPo tasks or activities could be added to the list below. The following HiPo tasks will be required to complete the approved scope of work:

☐	Working at heights > 4 ft (including aerial lifts, snooper trucks, scaffolds)	☐	Working in a controlled area
☐	Working in a confined space	☒	Extreme heat or cold stress environments
☐	Working in a trench or excavation	☐	Working with power tools/equipment (drill, chain saw, grinder, etc.)
☐	Performing tasks requiring lock out/tag out	☐	Working with/operating heavy equipment or machinery, including drill rigs
☐	Work on energized equipment	☐	Working in isolation from first aid services or immediate/emergency assistance
☐	Working with electricity	☒	Working around mobile equipment
☒	Working with hazardous substances or materials (including all HAZWOPER projects)	☐	Exposure to vehicular traffic (highways, roads, parking lots)
☐	Working with material under pressure	☐	All-Terrain Vehicle Work
☐	Working where there is a possible threat of violence, including civil unrest	☐	Working on Railroads or within 25 Feet of Tracks
☐	Working in avalanche areas	☐	Any activity/task involving non-voluntary use of respiratory protection, including for site access
☒	Working on or over water or ice	☐	Working with people diagnosed with coronavirus or other pandemic diseases
☐	Working in remote or wilderness isolation	☐	Other HiPo Task(s) [specify]: [Insert text]

The following AECOM procedures provide task specific permit requirements and shall be consulted if applicable to the scope of work (S3AM-218-PR):

☐	S3AM-120-PR, Radiation	☐	S3AM-304-PR, Fall Protection
☒	S3AM-209-PR, Risk Assessment & Management	☐	S3AM-310-PR, Cranes & Lifting Devices
☐	S3AM-301-PR, Confined Spaces	☐	S3AM-325-PR, Lockout Tagout
☐	S3AM-302-PR, Electrical Safety	☐	S3AM-330-PR, Underground Work
☐	S3AM-303-PR, Excavation	☐	S3AM-332-PR, Hot Work

3.0 AECOM SAFETY HEALTH AND ENVIRONMENT PROGRAM

3.1 AECOM POLICY

AECOM's Safety, Health and Environment Policy, which establishes the framework to attain best-in-class Safety, Health and Environmental (SH&E) performance in the interest of benefitting AECOM's employees and stakeholder in the global marketplace, is available on AECOM's Ecosystem (intranet).

3.2 SAFETY FOR LIFE

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

3.3 LIFE PRESERVING PRINCIPLES

AECOM has adopted these "Life-Preserving Principles" to help demonstrate the commitment of our Safety for Life program. We firmly believe these "Life-Preserving Principles" will enable AECOM to achieve its goal of zero employee injuries, property damage and an environmentally friendly and sustainable workplace. The nine Life-Preserving Principles, along with their descriptions, can be found on AECOM's Ecosystem (intranet).

3.4 DRIVING AND VEHICLE SAFETY

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

- Authorized Drivers - Managers must authorize drivers following evaluation of driver criteria to drive and maintain an AECOM-owned, leased or rented vehicle, a client or customer-owned vehicle, or a personal vehicle operated in the course of conducting AECOM business.

List of AECOM Authorized Drivers

1. Mark Love
2. AECOM Field Technician

- Electronic Devices Prohibited - AECOM prohibits use of all portable electronic devices while operating a motor vehicle/ equipment which includes being stopped at a traffic light or stop sign. This includes cell phones, two-way radios and other items whether hand-held or hands-free. Electronic devices include, but are not limited to, all mobile phones, pagers, iPods, MP3s, GPS, DVD players, tablets laptops and other portable electronic devices that can cause driver distraction. Hands-free device use is not allowed.
    - GPS units and devices used for navigation may only be used if factory installed or secured to the vehicle with a bracket that allows the driver to view the image without having to take their eyes off the road. Electronic devices shall be setup for operation prior to commencing driving activities and shall not be changed by the driver while driving.
- Vehicle Inspections - The driver shall conduct pre-trip vehicle inspections prior to each trip. A vehicle inspection checklist, S3AM-005-FM2, can be used to guide and document the inspection process. Vehicle inspection is to include a 360-degree walk around and visual inspection under the vehicle for leaks and obstructions prior to moving the vehicle.
- Training - All drivers shall complete defensive driver training. Additional training (i.e., hands-on defensive driver training) varies by BP Driver Type; see the CCAP for the AECOM Global BP Account's BP Remediation Management (RM) Program for more details. The CCAP incorporates by reference the AECOM Driving procedure S3AM-005-PR and SHE Training procedure S3AM-003-PR.
- Journey Management Plan - Drivers who undertake trips in excess of 250 miles (400 kilometers) one way, drive in remote or hazardous areas, or when otherwise deemed necessary, shall develop and document a Journey Management Plan using S3AM-005-FM1 or equivalent.
- Secure Loads - Cargo is only to be carried within the passenger compartment of a vehicle when segregated and restrained to prevent objects from becoming distractions, obstructions or projectiles to occupants should emergency vehicle maneuvers be required (e.g., harsh braking or crash). All goods transported on flatbed trucks or in pickup beds must be securely fastened to prevent them from becoming hazards. All

applicable laws and regulations regarding securing of loads must be met. It is prudent to check the load after a few miles to ensure that load has not shifted or loosened prior to completing the remainder of the trip.

- Backing Up - Reversing the vehicle is to be avoided if at all possible. If backing up is necessary, use the following guidelines:
  - Pre-plan all vehicle movements.
  - If the pull-through method of parking is not possible, drivers will scan parking spot/area for hazards and back in; thereby, facilitating departure where the first move is forward.
  - A light tap of the horn should be used to alert others of your intention to back up.
  - Avoid tight spaces.
  - Vehicles over 10,000 pounds gross vehicular weight are required to have a competent spotter in place when backing. A competent spotter is one that has received spotter training.
  - All vehicles shall have a competent spotter in place when backing in an active work zone. A competent spotter shall be used when backing a trailer. Parking and public access areas are recommended but not required to have a spotter.

3.5 FITNESS FOR DUTY

One of AECOM's nine Life-Preserving Principles is Fitness for Duty (see Fitness for Duty procedure S3AM-008-PR). Fitness for Duty means that individuals are in a state (physical, mental, and emotional) that enables them to perform assignments competently and in a manner that does not threaten the health and safety of themselves or others. On certain projects or for specific tasks, fit for duty certifications may be requested of medical providers by SH&E Managers or Human Resources (HR). Employees should report to work fit for duty and unimpaired by substances or fatigue. Supervisors must observe their employees and work with the employee, SH&E staff, and HR to address deficiencies. AECOM will not tolerate retaliation against any employee for filing a complaint or concern regarding their fitness for duty or participating in any way in an investigation.

3.5.1 Medical Surveillance

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

	Task or Exposure	Type of Screening or Surveillance
☒	Working in an exclusion zone and the regulatory required exposure limit is exceeded for 30 or more days a year.	• HAZWOPER Baseline (Initial) • HAZWOPER Annual • HAZWOPER Exit
☒	Working in an exclusion zone more than 30 days a year and the regulatory required exposure limit is not exceeded	• HAZWOPER Baseline (Initial) • HAZWOPER Biennial • HAZWOPER Exit
☐	Asbestos Contact/Removal	• Baseline (Initial) • Annual • Exit
☐	Silica	• Baseline (Initial) • Triennial (Every 3 Years)

	Task or Exposure	Type of Screening or Surveillance
☐	Respirator Use	• Baseline (Initial) • Biennial
☐	Forklift	• Physical (Triennial – Every 3 Years)

3.5.2 Proactive Health

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

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

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

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

3.5.3 Fatigue

One aspect of fit for duty is fatigue management. AECOM has developed procedures that limit work periods or requires additional rest under certain circumstances, including during long-distance travel or when working at high altitudes. These procedures also set limits on extended work periods of 14 hours per day or 60 hours per week. A fatigue management plan is required if longer working hours are necessary (see Fatigue Management Procedure S3AM-009-PR).

3.5.4 Fatigue and Driving Safety

The effect of fatigue is both physiological and psychological and can severely impair a driver's judgement. Fatigue can cause lapses in concentration which could prove fatal. Fatigue is not just a problem for drivers on long trips, as drivers can also suffer from fatigue on short trips.

After strenuous fieldwork, consider overnight accommodation or vehicle sharing for staff who are not acclimatized to the type of work. Microsleep can occur with a limited warning, and may be linked to several factors, for example:

- Microsleep is most likely to occur during times when the circadian rhythm dictates the body should be asleep, such as at dawn, late at night, or in the mid-afternoon (e.g. 1 and 4 am and 1 and 4 pm.).
- Potential to feel drowsy after a meal.
- Driving long distances (considered potentially monotonous), even with sufficient sleep.
- Prolonged sitting and warm ambient temperature may also increase the feeling of sleepiness.

If safe to do so, consider undertaking actions to disrupt the microsleep event while identifying a safe place to stop, e.g., open a vehicle window, listen to upbeat music/change music source or ask the passenger (if present) to engage in conversation. Ensure field staff are familiar with the signs of fatigue and mitigation factors. The most common visible signs of microsleep include:

- Eyelid drooping
- Head nodding
- Wandering thoughts
- Eyelid closure
- Brief periods of snoring

If any of the above become apparent, immediately pull over to a safe location and contact your TM or SH&E representative.

3.5.5 Substance Abuse

Drug and alcohol abuse pose a serious threat to the health and safety of employees, clients, and the general public as well as the security of our job sites, equipment and facilities. AECOM is committed to the elimination of illegal drug use and alcohol abuse in its workplace and regards any misuse of drugs or alcohol by employees to be unacceptable. AECOM Substance Abuse Prevention Procedure (S3AM-019-PR) prohibits the use, possession, presence in the body, manufacture, concealment, transportation, promotion or sale of the following items or substances on company premises. Company premises refer to all property, offices, facilities, land, buildings, structures, fixtures, installations, aircraft, automobiles, vessels, trucks and all other vehicles and equipment - whether owned, leased, or used.

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

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

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

3.6 REWARDS AND RECOGNITION

One of AECOM's Life Preserving Principles is Recognition and Rewards for proactive safety, health and environmentally focused behaviors. *All rewards and recognition programs emphasize the 9 Life Preserving Principles and proactive SH&E activities NOT solely the achievement of lagging metrics ("injury/incident-free" hours, etc.) as those may discourage incident reporting.*

BP Client Account Safety Star Program Nominate an AECOM employee or subcontractor: Safety Star Nomination Survey Question, details, or to make a nomination: timothy.gilles@aecom.com	*DCS Americas Programs* 1. AECOM Safety Star Recognition Program 2. AECOM Making a Difference Award 3. Executive Challenge Coins Program Details Available on Ecosystem

3.7 HAND SAFETY

The hands are exposed to hazards more than any body part. SH&E Hand Safety Procedure (S3AM-317-PR) describes requirements and best practices including these notable practices:

- All personnel shall have gloves in their immediate possession 100% of the time when in a shop or on a work site. Gloves that address the hazard shall be worn when employees work with or near any materials or equipment that present the potential for hand injury due to sharp edges, corrosives, flammable and irritating materials, extreme temperatures, splinters, etc. Use the Gloves Needs Assessment (S3AM-317-FM1) to help determine the appropriate glove for the hazard(s).

- Fixed open-blade knives are prohibited from use during the course of AECOM work. Examples of fixed open-blade knives include pocket knives, multi-tools, hunting knives, and standard utility knives. For more information about cutting tools, see S3AM-317-ATT1 Safe Alternative Tools.

3.8 CLEANING/DISINFECTING, HOUSEKEEPING AND PERSONAL HYGIENE

During the Pandemic, AECOM has identified three basic levels of cleaning that are described in our AECOM Pandemic Procedure. AECOM also requires that each location develop a Touch Point Cleaning program. Each project site shall implement a touch point cleaning program to minimize the transmission of the virus through environmental sources, specifically hard surfaces or "touch points." It is recommended that each site develop a checklist to identify the touch points specific to the site. The checklist can be initialed, dated, and signed for each touch point item to document the cleaning process. This cleaning should be conducted daily or more often as needed/desired. Contract a service or designate a person(s) and/or develop a schedule for cleaning responsibilities. Common touch points are listed below:

- Light Switches
- Equipment controls
- Cabinet and file drawer knobs/handles.
- Vending machines
- Chair arms
- Copier/printer/fax control buttons
- Shared desks and keyboards
- Shared tools and equipment
- Garage access buttons
- Handrails
- Doorknobs/handles
- Elevator buttons
- Sinks and Faucets
- Counter tops
- Tabletops
- Coffee pots
- Refrigerator
- Microwave
- Water dispensers
- Windowsills
- Portable toilet commonly touched areas
- Personal protective equipment (PPE) items

Basic housekeeping requirements for offices and work sites, as well as personal hygiene and sanitation standards can be found in S3AM-013-PR Housekeeping. Inspections will be performed at the regular interval specified below. The housekeeping inspection form S3AM-013-FM1 is available for use. Complete the table below regarding site-specific Housekeeping and Personal Hygiene requirements:

Cleaning/Disinfecting, Housekeeping and Personal Hygiene Requirements

Cleaning/Disinfecting:	*Frequency:*	Daily
	Responsible Party:	SS/SSO
Housekeeping:	*Inspection Frequency:*	Daily
	Inspector:	SS/SSO
Eating, Drinking & Smoking:	Permitted only in designated area(s) located outside of designated work areas	
Handwashing/Sanitizing:	Water, soap, hand sanitizer, and paper towels or equivalent supplies are located in the employee restroom. Site staff will wash or sanitize hands and wash face after completing work activities and prior to breaks or meals.	
Toilets:	Toilets are located at nearby stores.	

	A minimum of one toilet must be provided for every 20 personnel on site. For mobile crews where work activities and locations permit transportation to nearby toilet facilities on-site facilities are not required.
Water:	Water is located with the employee in the form of water bottles. A water supply meeting the following requirements will be utilized: *Potable Water:* An adequate supply of potable water will be available for field personnel consumption. Potable water can be provided in the form of water bottles, canteens, water coolers, or drinking fountains. Disposable drinking cups for single use and a waste receptacle will be provided as needed. Water containers will be refilled daily and disinfected regularly. Potable water containers will be properly identified in order to distinguish them from non-potable water sources. *Non-Potable Water:* Non-potable water may be used for hand washing and cleaning activities. Non-potable water will not be used for drinking purposes. All containers of non-potable water will be marked with a label stating *"Non-Potable Water, Not Intended for Drinking Water Consumption"*
Illumination:	Artificial illumination will not be provided. If natural light or installed lighting fixtures are not sufficient in the work area, toilet, and/or break area, then work activities will cease until adequate lighting is available.

3.9 NEWLY HIRED OR TRANSFERRED EMPLOYEES

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

The project scope of work does not currently involve SSEs. If it becomes necessary to use one or more SSEs to complete the project scope of work, then their competency will be evaluated and use on the project approved in advance by the AECOM Task Manager prior to mobilizing to site and listed in the Short-Service Employee Log below.

3.10 LONE WORKER

AECOM discourages employees from working alone (i.e. where AECOM personnel are out of visual and audio range of others) when performing field tasks (see SH&E Procedure S3AM-314-PR, Working Alone). Lone workers may not perform high-risk work (e.g. work near or over water) or work involving an activity-specific permit (e.g. confined space entry, energy isolation (LOTO), ground disturbance, etc.). If lone work is to be performed, a communications/check-in plan must be developed and implemented.

The project scope of work, as outlined in HASP Section 2.4, does not involve lone worker operations by AECOM or Subcontractor personnel. If a worker becomes out of visual and audio range with others, work will be immediately stopped, and the worker will re-establish contact before resuming work.

3.11 STOP WORK AUTHORITY

AECOM and BP empower and expect all employees to exercise their Stop Work Authority (see Stop Work Authority Procedure S3NA-002-PR) if an incident appears imminent, or when hazardous behaviors or conditions are observed. A stop work request can be informal if the situation can be easily corrected or may require shutting down operations if revised procedures are necessary to mitigate the hazard. If an AECOM employee observes an imminently hazardous situation on a site controlled by others (i.e., a client-managed contractor), the employee can always stop work for themselves by removing themselves from the situation. Employees also may attempt to stop work to avoid allowing the contractor to come to harm by immediately notifying the contractor foreman or site engineer, or if necessary, the client or party managing the contractor.

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

Note: Consistent with AECOM and BP policies, AECOM subcontractors are empowered and expected to exercise Stop Work Authority if an incident appears imminent, or when hazardous behaviors or conditions are observed on a BP site. The same requirements and expectations that apply to AECOM employees equally apply to AECOM subcontractors.

4.0 ROLES AND RESPONSIBILITIES

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

DCS Americas Incident Hotline: 1-800-348-5046

4.1 IPO PROGRAM ROLES

4.1.1 IPO Program Manager

The IPO Program Manager is Dave Espy. The alternate IPO Program Manager is Mike Niederreither. Within the IPO Program Organizational Structure, the IPO Program Lead serves as the overall project manager with site operational control (day-to-day operations) delegated to the Task Manager (TM). The IPO Program Lead is responsible to:

- Identify and communicate scope, standards, and objectives.
- Participate in planning.
- Approve Task Manager's assignment of key roles.
- Authorize activities within the IPO Program.
- Verify activity compliance with AECOM policies, principles and procedures and standards and IPO Program requirements.
- Participate in client updates and milestone reporting, including notification of SH&E events.
- Promotes AECOM's SH&E culture and Life Preserving Principles and IPO safety program and initiatives

4.1.2 IPO Program SH&E Manager

The IPO Program SH&E Manager is Tim Gilles. The IPO Program SH&E Manager is responsible to:

- Promote AECOM's SH&E culture and Life Preserving Principles and IPO safety program.
- Reviews and approve Site HASPs and other SH&E Plans.
- Approves the designated Site Safety Officer (SSO).
- Evaluate and Trend Key Performance Indicators.
- Reviews all personal exposure monitoring results.
- Conducts senior management observations, safety field audits/desktop reviews, and investigation of near misses and incidents.
- Identify corrective actions.
- Communicate safety program changes and lessons learned.
- Serve as a safety resource to the Program Team

4.2 SITE/PROJECT ROLES

4.2.1 Task Manager

The Task Manager has overall management authority and responsibility for all site operations, including safety. The Task Manager will provide the site supervisor with work plans, staff, and budgetary resources, which are appropriate to meet the safety needs of the project operations. Some of the Task Manager's specific responsibilities include:

- Project start-up activities require appropriate SH&E planning prior to work commencing, including identification of hazards, associated risk, and appropriate controls for each task and operation found in the work scope.
- Completed project risk registers /task hazard assessments (THAs) shall be incorporated into the Project's SH&E Plan.
- Verifying that personnel, to whom the ERP/HASP applies, including AECOM subcontractors, have received a copy of it, with ample opportunity to review the document and to ask questions.
- Providing the concurring SH&E Manager with updated information regarding conditions at the site and the scope of site work if changes occur that will affect the accuracy of the ERP/HASP.
- Providing adequate authority and resources to the Site Supervisor or Site Safety Officer to allow for the successful implementation of all necessary SH&E Procedures.
- Maintaining regular communications with the Site Supervisor or Site Safety Officer and, when necessary, the AECOM Client SH&E Program Manager.
- Coordinating the activities of AECOM subcontractors and ensuring that they are aware of the pertinent health and safety requirements for these projects, when applicable.
- Conducting Safety System Auditing by way of Management Site Visits and/or Project Manager Self-Assessments on a regular basis.
- Approving amendments to the ERP/HASP (in conjunction with the Site Supervisor or Site Safety Officer).
- Coordinating activities with the client as needed to ensure the safe implementation of the ERP/HASP.

4.2.2 Site Supervisor / Field Lead

The Site Supervisor has the overall responsibility and authority to direct work operations at the job site according to the provided work plans and ERP/HASP. The Task Manager may act as the Site Supervisor while on site. The Site Supervisor's responsibilities include:

- Discussing deviations or drift from the work plan with the Site Safety Officer and Task Manager.
- Discussing safety issues with the Task Manager, Site Safety Officer, and field personnel.
- Assisting the Site Safety Officer with the development and implementation of corrective actions for site safety deficiencies.
- Assisting the Site Safety Officer with the implementation of this ERP/HASP and ensuring compliance.
- Assisting the Site Safety Officer with inspections of the site for compliance with this ERP/HASP and applicable SH&E Procedures.
- Verifying that the Performing Authority (PA) has completed a crew review, including a review and when appropriate, updating, of the Task Hazard Assessment (THA) with the work crew.
- Reporting incidents and ensuring incidents and observations are logged into Lifeguard or IndustrySafe.
- Verifying that all operations are in compliance with the requirements of this ERP/HASP and halting any activity that poses a potential hazard to personnel, property, or the environment.
- Temporarily suspending individuals from field activities for infractions against the ERP/HASP pending consideration by the Site Safety Officer, the SH&E Manager, and the Task Manager.

If an alternate site supervisor/field lead is needed, the person assigned that role and their contact information will be communicated during the daily toolbox safety meeting.

4.2.3 Site Safety Officer

The Site Safety Officer supports the Site Supervisor in providing a safe work environment. Not all sites will have a designated Site Safety Officer; the decision should be made by the Task Manager and SH&E Manager taking into consideration the complexity and risks of the scope of work. The Site Supervisor may act as the Site Safety Officer on sites without one. The Site Safety Officer's responsibilities include:

- Updating the site-specific ERP/HASP to reflect changes in site conditions or the scope of work. ERP/HASP updates must be reviewed and approved by the SH&E Manager.
- Inspecting the site for compliance with this ERP/HASP and the SH&E Procedures using the appropriate field audit inspection checklist found in IndustrySafe.
- Coordinating with Site Supervisor to review THAs with the work crew.
- Assisting as needed to report incidents and verify that incidents and observations are logged into Lifeguard or IndustrySafe.
- Working with the Site Supervisor and Task Manager 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).
- Contacting the SH&E Manager for technical advice regarding safety issues.
- Determining emergency evacuation routes, establishing and posting local emergency telephone numbers, and arranging emergency transportation.
- Checking that all site personnel and visitors have received the proper training, orientation and medical clearance prior to entering the site.
- Establishing controlled work areas (as designated in this ERP/HASP or other safety documentation).
- Facilitating or co-leading daily tailgate meetings and maintaining attendance logs and records.
- Discussing potential SH&E hazards with the Site Supervisor, the SH&E Manager and the Task Manager.
- Selecting an alternate Site Safety Officer by name and informing him/her of their duties, in the event that the Site Safety Officer must leave or is absent from the site.

- Verifying that all operations are in compliance with the requirements of this ERP/HASP.
- Issuing a “Stop Work Order” under the conditions set forth in this ERP/HASP.
- Temporarily suspending individuals from field activities for infractions against the ERP/HASP pending consideration by the SH&E Manager and the Task Manager.

If an alternate Site Safety Officer is needed, the person assigned that role and their contact information will be communicated during the daily toolbox safety meeting.

4.2.4 Employees

Responsibilities of employees associated with this project include, but are not limited to:

- Understanding and abiding by the SH&E Procedures specified in the ERP/HASP and other applicable safety policies, and clarifying those areas where understanding is incomplete.
- Providing feedback to SH&E management for continuous improvement relating to omissions and modifications in the ERP/HASP or other safety policies and procedures.
- Notifying the Site Supervisor or Site Safety Officer of unsafe conditions and acts.
- Stopping work if there is doubt about how to safely perform a task or if unsafe acts or conditions are observed (including subcontractors or team contractors).
- Speaking up and refusing to work on any site or operation where the SH&E procedures specified in this HASP or other safety policies are not being followed.
- Contacting the Site Supervisor or Site Safety Officer or the SH&E Manager at any time to discuss potential concerns and update the THA in the field to reflect the modifications
- Provide THA feedback to the supervisor for continuous improvement.

4.2.5 Subcontractors

The requirements for AECOM direct-hire/level 2 (L2) subcontractor selection and subcontractor safety responsibilities are outlined in AECOM Procedure S3AM-213-PR, Subcontractor Management. Each L2 subcontractor is responsible for assigning specific work tasks to their employees. Each L2 subcontractor's management will provide qualified employees and allocate sufficient time, materials, and equipment to safely complete assigned tasks. In particular, each subcontractor is responsible for equipping its personnel with any required personnel protective equipment (PPE) and all required training.

Each L2 subcontractor that will be contracting any portion of their scope of work is required to obtain authorization to use subcontractors, level 3 and beyond (L3+), that were not directly hired by AECOM prior to their mobilization to site. In addition, L2 subcontractor is required to communicate both AECOM and BP requirements and expectations to their subcontractors. The AECOM TM is required to confirm that all subcontractors used on the project meet both AECOM and BP Safety, Health and Environment (SH&E) Evaluation Criteria, requirements and expectations. This includes confirming that individuals are competent to perform their assigned tasks and duties, obtaining authorization to use one or more short service employees, and confirming that verification of competency can be provided upon request.

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

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

The project scope of work involves the use of one or more subcontractor. Each subcontractor has been prequalified in AECOM's SUBPORT and has been evaluated and approved in accordance with AECOM's requirements and expectations. The certification of subcontractor evaluation and subcontractor variances, if applicable, are provided in Attachment G. Subcontractors involved in the performance of the scope of work are listed in the Subcontractor Log below.

Subcontractor Log ☐ None – Not Applicable ☒ See Below

Level [1]	Company Name	SH&E Var.[2]	Project Task(s)	Field Lead/SSO
L2	Cascade Environmental Services	No	Drilling, Well Installation	John Diamond
L2	CorBuilt, LLC	No	Utility Locating	A.J. Cholakis
L2	Maser Consulting	Yes	Surveying	Lucas Boyer

Notes: Level[1] = Contracting Level: L2 = AECOM Direct-Hire Subcontractor; L3 = Sub of a Subcontractor; L4 = Sub of Sub of Subcontractor
SH&E Var.[2] = SH&E Variance: Yes = Approved variance was required to use the sub; No = Sub met SH&E Eval. Criteria/No variance required

4.2.6 Visitors

Authorized visitors (e.g., client representatives, regulators, AECOM management staff, etc.) requiring entry to any work location on the site will be briefed by the Task Manager, Site Supervisor, or Site Safety Officer 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 that are required for entry to any controlled work area; visitors must comply with these requirements at all times.

If the site visitor requires entry to any exclusion zone (EZ), but does not comply with the above requirements, the visitor will be denied access to the EZ. If the visitor disregards instructions to remain outside the EZ, work activities will be immediately suspended, and the situation reported and documented.

Unauthorized visitors, and visitors not meeting the specified qualifications, will not be permitted within established controlled work areas. If unauthorized visitors and/or visitors not meeting the specified qualifications enter a controlled work area and/or EZ, work activities will be immediately suspended, and the situation reported and documented.

5.0 TRAINING AND DOCUMENTATION

The following sections describe the standard practices or programs that AECOM will establish to prepare employees to perform work safely and consistent with AECOM policy and Procedures.

The following sections describe the standard practices or programs that AECOM will establish to prepare employees to perform work safely and consistent with AECOM policy and Procedures.

5.1 ERP/HASP AND SITE ORIENTATION

The Task Manager shall conduct a project/site-specific ERP/HASP orientation prior to the start of field operations, with support from or delegation to the SH&E Manager, Site Safety Officer, and/or Site Supervisor/Field Lead. This meeting will involve representatives from all organizations with a direct contractual relationship with AECOM on the job site. Minimum items to be covered are listed in Attachment F. Participants will then sign the ERP/HASP Personnel Acknowledgement register at the end of the HASP.

5.2 DAILY TOOLBOX SAFETY MEETINGS AND CREW REVIEWS

The Site Supervisor, Site Safety Officer or designee shall facilitate a tailgate safety meeting to discuss the specific requirements of this ERP/HASP, review the applicable work permits and complete Daily Tailgate Meeting Record (DMTR) prior to the commencement of daily project activities. Attendance at the daily tailgate safety meeting is mandatory for all employees and subcontractors at the site contracted to AECOM or an AECOM subcontractor. When simultaneous operations exist, work crews are encouraged to attend each other's tailgate safety meetings or at the very least the supervisors shall discuss the coordination of activities and associated hazards of each other's tasks with the Person-in-Charge (PIC). The PIC will coordinate simultaneous operations between the work crews and advise the site supervisor/field leads on task sequencing and limitations. The supervisor will then convey the information to the work crew. The Tailgate Safety Meeting must be documented by the Site Supervisor or Site Safety Officer on the DMTR form, a blank copy of which is included in Attachment H.

Prior to the start each individual task at the Site, the supervisor/field lead will conduct crew review to discuss the assigned task, including a review of the Task Hazard Assessment (Attachment G), applicable permits, and related SH&E plans, with the work crew. The review must include a discuss of the task(s) to be completed, associated hazards, identified control measures, parties responsible for implementing and verifying the effectiveness of the control measures and the level of risk. A field level or last minute risk assessment shall be performed using 4sight to identify any new hazards and any additional control measures needed for the work to be safely performed. The THA must be updated to reflect any new hazards and control measures identified. Hand markups of the THA are acceptable. Changes or updates to the THA should be reviewed with entire crew prior to resuming work. Crew reviews may be conducted as part of the daily tailgate safety meeting or separately depending on the number of tasks and work crews.

5.3 WORKER TRAINING AND QUALIFICATIONS

All personnel at this site must be qualified and experienced in the tasks they are assigned. SH&E Training Procedure S3AM-003-PR establishes the general training requirements for AECOM employees. S3AM-117-PR, Hazardous Waste Operations, explains the HAZWOPER training and S3NA-128-PR, Medical Screening and Surveillance, details the medical surveillance requirements.

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

Site Specific Training Requirements

Training		Applies to
☒	ERP/HASP and Site Orientation	All Employees and Subcontractors
☒	Vehicle/Driver Safety & Defensive Driving	All Employees who drive on behalf of AECOM
☒	Field Safety	Employees visiting the field that does not require HAZWOPER
☒	Speak Up/Listen Up (SULU)	All AECOM field employees and supervisors
☒	First Aid / CPR	Designated employees or employees performing high risk activities and medical attention is more than 4 minutes away

Site Specific Training Requirements

Training		Applies to
☐	Respiratory Protection & Fit Test	Employees needing to wear respirators
☒	OSHA 10-Hr. Construction Safety (or CSTS 2020 in Canada)	Refer to Section 5.3.1 for guidance
☒	OSHA 30-Hr. Construction Safety	Refer to Section 5.3.1 for guidance
☒	HAZWOPER 40-Hour and 8-Hr. Annual Refresher	On HAZWOPER sites, in EZ, exposed to hazardous contamination
☒	HAZWOPER Supervisor	Employees managing others in HAZWOPER activities or at HAZWOPER Sites
☐	Hazardous Materials Shipping (U.S.)	Employee responsible for shipping HZM/HZW/DG and/or signing manifests
☐	Transportation of Dangerous Goods (CAN)	Employees responsible for shipping/transporting regulated hazardous materials that exceed regulatory requirements
☐	Annual Medical Surveillance / Clearance	Employees working in an exclusion zone and the regulatory required exposure limit IS exceeded for 30 or more days a year
☒	Biennial Medical Surveillance / Clearance	Working in an exclusion zone more than 30 days a year and the regulatory required exposure limit is NOT exceeded
☐	Under Bridge Inspection Unit (UBIU) AECOM University module	Employees working in a UBIU
☒	All-Hands Coronavirus Training:	All Employees performing work during the COVID-19 Pandemic
☐	Local Requirements:	
☒	Client Requirements:	As outlined in the CCAP for the AECOM Global BP Account's BP Innovative Portfolio Offering (IPO) Program

Each AECOM employee working on the BP Account must annually complete or update their SH&E Training Matrix S3AM-003-FM1, SH&E Level IV – C BP Training Matrix and corporate resume/CV. In addition, Short Service Employees (SSEs) must complete SSE Form for field staff. These documents along with confirmation training has been completed and is current must be provided to the AECOM Task Manager. The AECOM TM is responsible to review and approve employee training and competency documentation and confirm staff assignments are consistent with their level of competency.

Subcontractor employees working on the BP Account must be vetted through the Subcontractor Pre-Work Package. Only subcontractor employee for which their training and competency information was submitted to and approved by the AECOM Task Manager may perform work at the site. The AECOM Task Manager is responsible to review and approve subcontractor training and competency evaluations.

5.3.1 OSHA 10-Hour/OSHA 30-Hour Training

OSHA 10 (or CSTS 2020 in Canada) and OSHA 30 training is required for projects with construction, demolition or construction/industrial-like hazards. "Construction//industrial-like hazards" occur on sites where the focus is not construction/industrial activities, but where our scope includes work activities involving work at heights, confined space, hot work, and/or lifting/hoisting loads or work around heavy construction equipment or "yellow iron." Examples of heavy construction equipment include excavators, bull dozers, graders, articulated dump trucks, pile drivers, and large air or mud rotary drill rigs. Smaller equipment like bobcats, road worthy commercial trucks, and hollow-stem auger drill rigs would not be considered heavy construction equipment.

This training is needed if this type of work is being performed within our work area or if it may impact our work area. It is not applicable if our work area is separated from the construction/demolition/industrial area with enough distance or physical barriers that fully prevent exposure of our team to those hazards. This includes projects where we serve as Inspectors, or any work where our employees are exposed to construction/industrial site hazards.

OSHA 30 hr. training is required for supervisors in the United States. The term "supervisor" has many different meanings. The requirement to complete the OSHA 30 hr. course will be based on field supervisory roles and responsibilities, not administrative supervision roles. Field supervisors required to take the OSHA 30 course are defined as those individuals who provide work direction and leadership directly to AECOM field personnel and/or our subcontractors for construction/demolition activities or tasks that have construction/industrial-like hazards. These supervisors must be knowledgeable of construction hazards and controls because they are responsible for:

- Field implementation of a construction/demolition scope of work
- Controlling performance on the job site
- Evaluating and controlling hazards & preventing site safety risks
- Intervening to prevent unsafe actions or conditions of employees, clients, and subcontractors related to construction/demolition hazards

5.4 COMPETENT PERSON

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

AECOM's Competent Person Designation Procedure, S3AM-202-PR, explains the roles, responsibilities and procedures of naming a competent person. Complete the table below and include a S3AM-202-FM Competent Person Designation Form for each AECOM competent person (subcontractors to use an equivalent process). These activities require a competent person.

Competent Person Log

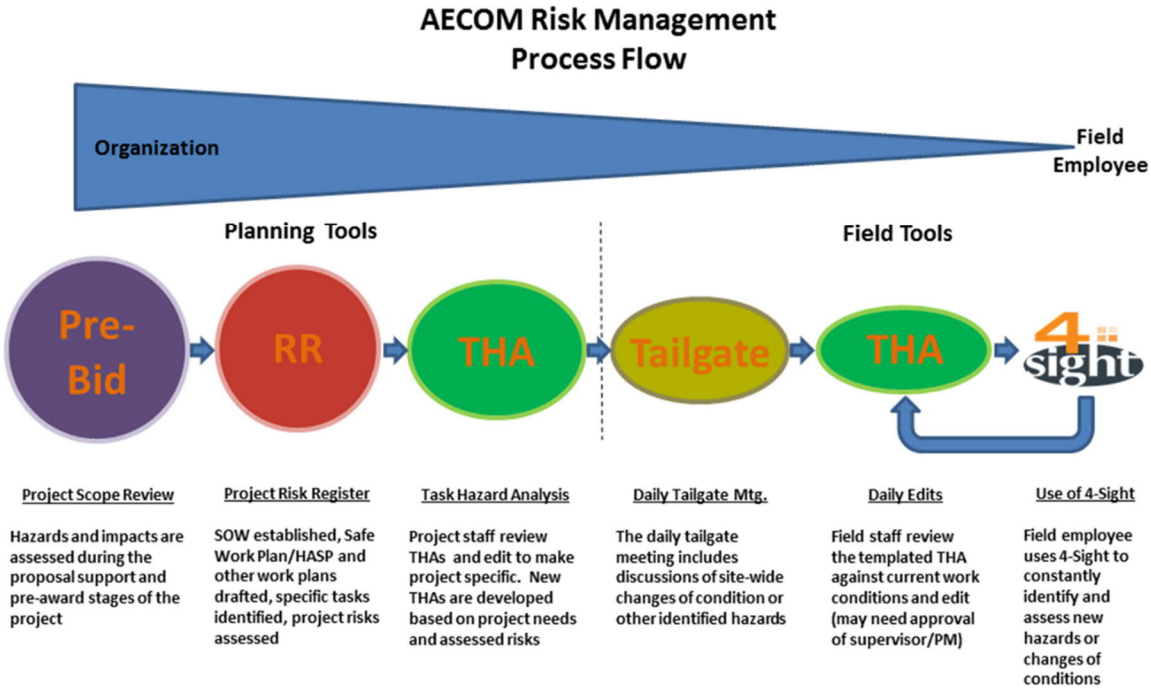
Activity / Area of Competency	Name of Person / Company or Affiliation
☐ Asbestos	
☐ Assured Equipment Grounding Conductor	
☐ Blasting & Explosives	
☒ Concrete & Masonry Construction	Subcontractor
☐ Confined Spaces	
☒ Control of Hazardous Energy (Lockout-Tagout)	Subcontractor
☐ Crane Assembly / Disassembly	
☐ Cranes & Derricks	
☐ Demolition	
☐ Electrical Wiring Design & Protections	
☒ Elevated Work Platforms & Aerial Lifts	Subcontractor
☐ Fall Protection	
☒ Hearing Protection	To be determined – Prior to noise exposure above 85 dB
☒ Heavy Equipment	Subcontractor

Competent Person Log

Activity / Area of Competency	Name of Person / Company or Affiliation
☐ Ionizing Radiation	
☐ Lead	
☐ Material Hoists & Personnel Hoists	
☐ Respiratory Protection	
☐ Rigging Equipment	
☐ Scaffolds	
☐ Stairways & Ladders	
☐ Steel Erection	
☒ Trench & Excavations	Subcontractor
☐ Underground Construction	
☐ Welding & Cutting	

6.0 HAZARD ASSESSMENT AND CONTROL

AECOM has adopted an approach to hazard assessment and control that incorporates both qualitative and quantitative methods to identify hazards and the degree to which they may impact employees and AECOM operations. See S3AM-209-PR, Risk Assessment and Management, for details regarding AECOM's process. This approach is illustrated below and described in the following section.



6.1 SH&E PROCEDURES

All AECOM SH&E procedures, in their controlled copy version, are available on the internal SH&E Policy and Procedures ecosystem page. Programmatic procedures referenced in this document (for example SH&E Training) do no need to be printed for inclusion in this HASP. The applicable field procedures checklist is in the Physical Hazards section below and procedures are included in Attachment C.

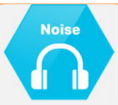
6.2 TASK HAZARD ASSESSMENTS AND DAILY TAILGATE MEETING FORM

THA forms (a blank version is included in located in S3AM-209-PR) shall be prepared for each task to be performed as part of the scope of work. This includes driving to the site, parking, and walking as well as the hazards, associated risk, and appropriate controls for all other work activities. The DCS Americas Templated THA Library may also be used to find previously approved THAs, though these should be modified to be project and site-specific. The preparer shall have one THA form for each task in the Scope of Work found in this work plan (Attachment F) and shall also include blank copies.

In the field, all employees and visitors shall review the daily the THAs and complete and sign the Daily Tailgate Meeting Form S3AM-209-FM5. Many times, when employees arrive in the field, situations are different than originally planned for or additional job steps are required. The THA asks workers update or 'dirty up' the THA in the 'On-Site Edits' rows to assess the risks presented by the changed condition and requires the worker to describe steps to reduce the risk. If the hazard(s) cannot be successfully mitigated, the work is not allowed to proceed.

6.2.1 Hazard Categories

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

Category	Definition
	A biological hazard is any living organism that could cause irritation, allergic reaction, bites, stings, illness, infection or other injury.
	A chemical hazard is any chemical substance that could potentially cause harm to humans, equipment, or the environment either through contact, ingestion, absorption, inhalation, or reaction.
	Electrical hazards are present whenever there is potential for contact with an electric charge
	Gravitational force can cause tools, equipment, materials and people to fall either to the same level or from heights to the earth or a lower surface.
	A mechanical hazard when there is energy within the components of a mechanical system within an otherwise stationary piece of equipment/machinery.
	Objects or substances that can move or are moving not due to gravity create a motion hazard. Motion hazards also include body motions and positioning such as bending, stretching, kneeling, etc.,
	Noise hazards are sounds that may prevent effective communication or cause hearing loss.
	Any physical matter such as gases, liquids and springs that is compressed or under a vacuum creates a pressure hazard.
	Radiation hazards include both ionizing and non-ionizing energy emitted from radioactive elements or sources.
	Thermal hazards can cause injury or damage due to their temperature.

6.3 4 SIGHT

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

- What am I about to do?
- What could go wrong?
- What could be done to make it safer?
- What have I done to communicate the hazard?

6.4 SPEAK UP/LISTEN UP

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

- Speak Up where employees use three simple steps when providing feedback to others about unsafe acts:
  - Ask to discuss their hazard assessment or 4-Sight for the task
  - Get a commitment from the employee to apply the hazard controls and perform the task according to the accepted procedures
  - Follow up to ensure the employee is working safely

- Listen Up where employees use two simple steps when responding to safety feedback:
  - Listen – Focus on the message, not the messenger
  - Commit to performing the task the safer way

SULU conversations should happen consistently throughout the work day to create clear expectations of how work should be performed. All employees should recognize safe work behaviors in order to reinforce them and keep them going. An occasional correction is much more effective when employees are frequently encouraged and positively recognized for their safe actions. Managers and supervisors should be having SULU conversations during site visits and ensure peer to peer and site supervisor to crew SULU conversations are being held.

7.0 BIOLOGICAL AND PHYSICAL HAZARD ASSESSMENT

A physical hazard is a hazard that threatens the physical safety of an individual; contact with the hazard typically results in an injury. The following table summarizes the physical hazards or activities containing physical hazards present at the site and those that are applicable to the scope of work as outlined in Section 2.4. The identified procedures that address protection and prevention of harm are provided in Attachment A for implementation and reference.

	Hazard/ Activity	Applicable Procedure		Hazard/ Activity	Applicable Procedure
☐	Abrasive Blasting	S3AM-335-PR	☒	Aerial Work Platforms	S3AM-323-PR
☐	All-Terrain Vehicles	S3AM-319-PR	☐	Blasting and Explosives	S3AM-336-PR
☐	Bloodborne Pathogens	S3AM-111-PR	☐	Cofferdams	S3AM-344-PR
☒	Cold Stress	S3AM-112-PR	☐	Compressed Air Systems and Testing	S3AM-337-PR
☐	Compressed Gases	S3AM-114-PR	☒	Concrete Work	S3AM-338-PR
☐	Confined Spaces	S3AM-301-PR	☐	Corrosive Reactive Materials	S3AM-125-PR
☐	Cranes and Lifting Devices	S3AM-310-PR	☐	Demolition	S3AM-339-PR
☐	Diving (scientific and commercial)	S3AM-334-PR	☒	Drilling, Boring & Direct Push Probing	S3AM-321-PR
☒	Electrical Safety	S3AM-302-PR	☐	Excavation	S3AM-303-PR

	Hazard/ Activity	Applicable Procedure		Hazard/ Activity	Applicable Procedure
☐	Fall Protection	S3AM-304-PR	☒	Flammable and Combustible Liquids	S3AM-126-PR
☐	Gauge Source Radiation	S3AM-122-PR	☒	Hand and Power Tools	S3AM-305-PR
☒	Hazardous Waste Operations	S3AM-117-PR	☒	Heat Stress	S3AM-113-PR
☒	Heavy Equipment	S3AM-309-PR	☐	High Altitude	S3AM-124-PR
☐	Highway and Road Work	S3AM-306-PR	☐	Hoists Elevators and Conveyors	S3AM-343-PR
☐	Hot Work	S3AM-332-PR	☐	Ladders	S3AM-312-PR
☐	Lockout Tagout	S3AM-325-PR	☐	Machine Guarding Safe Work Practice	S3AM-326-PR
☐	Marine Safety and Vessel Operations	S3AM-333-PR	☒	Material Storage	S3AM-316-PR
☐	Mine Site Activities	S3AM-341-PR	☐	Mining Operations	S3AM-345-PR
☒	Non Ionizing Radiation	S3AM-121-PR	☒	Overhead Lines	S3AM-322-PR
☒	Pandemic Virus	SR1-003-PR2	☐	Powder-Actuated Tools	S3AM-327-PR
☐	Powered Industrial Trucks	S3AM-324-PR	☐	Radiation	S3AM-120-PR
☐	Railroad Safety	S3AM-329-PR	☐	Respiratory Protection	S3AM-123-PR
☐	Scaffolding	S3AM-311-PR	☐	Steel Erection	S3AM-340-PR
☐	Temp. Floors, Stairs, Railings, Toe-boards	S3AM-342-PR	☒	Underground Utilities	S3AM-331-PR
☐	Underground Work	S3AM-330-PR	☒	Wildlife, Plants and Insects	S3AM-313-PR
☐	Working Alone	S3AM-314-PR	☒	Working On and Near Water	S3AM-315-PR

7.1 CONFINED SPACES

There are no known confined spaces with the work/project area. If confined spaces are identified, they will be communicated to the project team by the AECOM Site Supervisor.

7.2 OVERHEAD LINES AND OBSTRUCTIONS

There are known overhead lines and/or obstructions that will be encountered to access and/or perform work within the work/project area. The type of overhead line along with any associated voltage will be determined prior to entering a 50-foot/16.8-meter radius. Once voltages are determined, the applicable minimum approach distances (see S3AM-322-PR1) will be communicated to the field team by the AECOM Site Supervisor.

7.3 PANDEMIC VIRUS

COVID-19 is a disease that results from infection of the virus identified as SARS-CoV-2. SARS-CoV-2 is a Coronavirus, one of a large family of viruses found in both animals and humans. Some infect people and are known to cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) with symptoms such as fever, cough, and shortness of breath. There currently is no human vaccine available for this virus.

Key AECOM resources can be found at the AECOM Ecosystem Coronavirus Information Center on the Ecosystem homepage or at this link, the Coronavirus Smart Card, and the AECOM Pandemic Procedure: SR1-003-PR2. Additional resources can be found at the following non-AECOM websites:

- Center for Disease Control and Prevention (CDC).
- World Health Organization (WHO)..

8.0 CHEMICAL HAZARD ASSESSMENT

A chemical hazard is a type of occupational hazard caused by exposure to chemicals in the workplace. Exposure to chemicals in the workplace can cause acute or long-term detrimental health effects. Potential exposure to chemical hazards on AECOM projects can come from several sources including materials brought on site to perform work, constituents of concern found in environmental media under investigation, and simultaneous operations being performed at the site by the property owner/third parties.

8.1 POTENTIAL EXPOSURE PATHWAYS

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

8.1.1 Inhalation

The primary risks associated with AECOM's scope of work pertain to potential exposure to airborne contaminants and explosion hazards. Constituents that potentially pose an occupational concern to employees by the inhalation route are carbon monoxide, hydrogen sulfide, methane, and volatile organic compounds. Air monitoring may be performed in the work area and within the employee's breathing zone to assess the need to implement appropriate control measures or stop work. In addition, air monitoring will be performed at the source to assess potential explosion hazards. See HASP Section 9, Air Monitoring for additional information regarding the air monitoring requirements for this project.

8.1.2 Absorption (Skin Contact)

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

8.1.3 Ingestion

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

8.1.4 Exposure Pathway Evaluation

Depending on the source of potential chemical hazard and the likelihood of exposure, certain measures will be taken to protect AECOM employees as specified below.

☒	Exposure to chemical hazards are not anticipated
☒	Hazardous chemicals will be used to perform the work
☒	Exposure to constituents of concern found in environmental media is likely
☐	Exposure to chemical hazards are possible due to activities of the site owner or other parties
☒	Hazardous, solid, and/or municipal wastes (e.g., contaminated PPE, empty bags of cement/bentonite, soil waste, and purged groundwater) will likely be generated during any phase of the project

8.2 HAZARDOUS MATERIALS COMMUNICATION

Hazardous materials that will be used on the site to perform the work can include a variety of products including sample preservatives, grout, concrete, paints, adhesives, decontamination solutions, etc. Safety data sheets (SDSs) must be available for all hazardous products that will be stored or used on the site that exceed usual household quantities.

Their properties, hazards, and associated required controls will be communicated to all affected staff and subcontractors in accordance with the requirements of AECOM Procedure S3AM-115-PR Hazardous Materials Communication including these key elements:

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

In addition, any employee or organization (contractor or subcontractor) intending to bring any hazardous material onto this AECOM-controlled work site must first provide a copy of the item's SDS to the Site Supervisor or Site Safety Officer for review and filing. The Site Supervisor or Site Safety Officer will maintain copies of all SDS on site and in Attachment F. SDS may not be available for locally obtained products, in which case an alternate form of product hazard documentation will be acceptable.

See S3AM-110-PR, Toxic and Hazardous Substances, for information on planning, training, monitoring, and details on several specific chemicals (Benzene, Cadmium, Chromium, Hydrogen Sulfide, Lead, and Silica).

8.3 CONSTITUENTS OF CONCERN

Based on information obtained from historical investigations and other sources, the chemicals in the table below are known or suspected to be present at the site.

Summary of Hazardous Properties of Contaminant Exposure Hazards

Notes:	PEL.....Permissible Exposure Limit TLV.....Threshold Limit Value	IP.....Ionization Potential eV.....Electron Volt			
Chemical Name	Media	Primary Routes of Exposure	PEL	TLV	IP (eV)
Other Common Site COCs					
1,2-Dichloroethane	Soil, GW	Inhalation, ingestion, skin absorption, skin and/or eye contact	50 ppm	10 ppm	11.05
111-Trichloroethane	Soil, GW	Inhalation, ingestion, skin and/or eye contact	350 ppm	350 ppm	11.00
1,1-Dichloroethane	Soil, GW	Inhalation, ingestion, skin and/or eye contact	100 ppm	100 ppm	11.06
1,1-Dichloroethene	Soil, GW	Inhalation, ingestion, skin and/or eye contact	NA	5ppm	10.00
Acetone	Soil, GW	Inhalation, ingestion, skin and/or eye contact	1000 ppm	250 ppm	9.69
Chloroethane	Soil, GW	Inhalation, ingestion, skin and/or eye contact	1000 ppm	100 ppm	10.97
Methylene Chloride	Soil, GW	Inhalation, ingestion, skin and/or eye contact	25 ppm	50 ppm	11.32
Trichloroethene	Soil, GW	Inhalation, skin adsorption, ingestion, skin and/or eye contact	50 ppm	10 ppm	11.05
Cis-1,2-Dichloroethene	Soil, GW	Inhalation, skin adsorption, ingestion, skin and/or eye contact	200 ppm	200 ppm	9.65
Vinyl Chloride	Soil, GW	Inhalation, ingestion, skin and/or eye contact	1 ppm	1 ppm	9.99
Naphthalene	Soil, GW	Inhalation, skin absorption, ingestion, skin and/or eye contact	10 ppm	10 ppm	8.12
Tetrachloroethylene (PCE)	Soil, GW	Inhalation	100 ppm	25 ppm	9.32

8.3.1 Decontamination

All possible and necessary steps shall be taken to reduce or minimize contact with chemicals and contaminated/impacted materials while performing field activities. Decontamination steps are outlined in Section 4.7 of the Hazardous Waste Operations procedure S3AM-117-PR. Some key elements are as follows:

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

Decontamination Procedures and Equipment

Procedure	Equipment Needed
Wipe clean	Paper towels
Dry	Air dry or use paper towels
[	

Equipment Decontamination Procedures

Type of Equipment	Decontamination Solution	Procedure
IP/Water Level Meter	Alconox and Water	Brush loose debris from equipment. Spray with decon solutions. Wipe clean and dry with paper towel.
Drilling equipment	Alconox and Water	Brush loose debris from equipment. Scrub with alconox solution. Rinse with water.
Excavator	Water	Brush loose debris from equipment.

Waste Handling for Decontamination

Waste Stream(s)/Product(s)	Disposal Procedure(s)
Paper towels	Discard in trash bag.
Nitrile gloves	Discard in trash bag.
Small tools decon water	Collect in appropriate container for transport to onsite treatment building sump.
Large equipment decon water	Collect in appropriate container for characterization and disposal.

8.4 SITE CHEMICAL HAZARDS OUTSIDE OF AECOM CONTROL

AECOM frequently performs work at Client sites that are engaged in chemical manufacturing or use chemicals as part of the manufacturing process. These types of operations can potentially expose AECOM and AECOM subcontractors to chemicals. The following mitigation measures should be applied to all work performed on these sites.

- Be familiar with the facility emergency alarms/alerts
- Know where the assembly areas are for each area of proposed site activity (note that assembly areas may be dependent on the direction of the prevailing wind)
- Be familiar with the products used on site and the appropriate response measures (may differ based on location on site)
- Discuss the above as part of daily tailgate meetings.

The client or host facility/site does not engage in chemical manufacturing or use chemicals as part of their manufacturing, industrial and/or commercial process. Therefore, a potential exposure to site chemical hazards outside of AECOM's control is not anticipated.

8.5 HAZARDOUS MATERIALS HANDLING AND WASTE MANAGEMENT

If hazardous, solid, and/or municipal wastes (e.g., contaminated PPE, empty bags of cement/bentonite, soil waste, and purged groundwater) are generated during any phase of the project, the waste shall be segregated, accumulated, labeled, and disposed of in accordance with applicable Federal, State, Provincial, Territorial and/or local regulations, SH&E Procedure S3AM-116-PR Hazardous Materials Shipping, and site-specific requirements as determined by BP site management.

AECOM should ensure that it does not take legal ownership of any wastes that may be produced as a result of our work at the site, through signing manifests. A site-specific Entity Letter may be required for the site/client; if so, only persons named on the entity letter are allowed to sign waste shipping papers "as an Agent of [client name]". Any individual signing shipping papers must have valid Department of Transportation and Resource Conservation and Recovery Act training for waste shipment. Consult the HZM/HZW & TDG page on ecosystem or the SH&E Manager for further guidance on AECOM and regulatory procedures and training requirements.

8.5.1 Site-Specific Waste Management Plan

Waste generated on site, e.g. contaminated PPE, empty bags of cement/bentonite, soil waste, purged groundwater, will either be treated on-site or segregated and disposed of in accordance with current local regulations.

- Any drums/containers used for temporary waste storage, including purged groundwater and soil cuttings, should be labelled appropriately.
- Waste should be temporarily stored such that no material can contaminate the surrounding environment.
- Store adequately labelled waste in designated areas isolated from surface drains.
- Cover waste storage containers to prevent windblown dust and litter.

AECOM is authorized to arrange for the management of waste on behalf of BP. However, AECOM is not registered as a Waste Carrier, and is therefore not authorized to transport controlled waste. Proper waste pick-up should be coordinated with the appropriate AECOM PM.

9.0 AIR MONITORING

Depending on the contaminants of concern, the products used to perform the work, or third-party operations, sampling or monitoring may be required within the work area on site to detect the presence and relative levels of chemical or particulate hazards. The data collected throughout monitoring shall be used to determine the appropriate levels of PPE. Monitoring shall be in accordance with Exposure Monitoring Procedure S3AM-127-PR and specified in the work permit and/or THA for the tasks. Key elements of the procedure include:

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

Potential exposure to chemical hazards from sources including materials brought on site to perform work, constituents of concern found in environmental media under investigation, and/or simultaneous operations being performed at the site by the property owner/third parties are reasonably anticipated to have the potential to result in vapors, fumes, aerosols, mists, and/or airborne particulates/dusts at or near permissible exposure limits. Therefore, air monitoring that will be implemented is described below.

9.1 REAL-TIME EXPOSURE MEASUREMENT/EQUIPMENT

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

Air Monitoring Instruments

Instrument	Manufacturer/Model	Substances Detected
☒ Photo Ionization Detector (PID)	RAE Systems mini-RAE Photovac Microtip HNu Model HNu (minimum 10.6 eV bulb)	• Petroleum hydrocarbons • Organic solvents
☒ Multi or 4-Gas Detector	RAE Systems Multi-RAE	• Lower Explosive Limit (LEL) • Oxygen • Carbon Monoxide • Hydrogen Sulfide
☐ Combustible Gas Indicator (CGI) *May be combined with individual or multi-gas detectors*		• Explosivity
☐ Particulate Monitor	MIE Model PDM-3 Mini-RAM	• Aerosols, mists, dust, and fumes
☐ Personal Monitor(s)/Badge(s)	[Insert]	• [Insert]

9.2 HEALTH AND SAFETY ACTION LEVELS

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

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

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

Reasons to Upgrade:

- Known or suspected presence of dermal hazards;
- Occurrence or likely occurrence of gas, vapor, or dust emission; or
- Change in work task that will increase the exposure or potential exposure to hazardous materials.

Reasons to Downgrade:

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

9.3 MONITORING PROCEDURES

The monitoring procedures shown below are general guidelines for sampling activities. In general, readings are considered actionable if sustained readings are observed for 5 minutes or more or if intermittent peaks are seen in excess of 1 times the response level. A reading in excess of action level outlined below will require additional ventilation (natural or mechanical) for 30 minutes, followed by re-monitoring.

Volatile Organic Compounds (VOCs) and Volatile Hydrocarbons

Equipment/Instrument: Photo Ionization Detector (PID)

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously during tasks where exposure to VOCs and volatile hydrocarbons is possible	< 5 ppm	• Continue monitoring • Continue work in the required PPE
	5 – 25 ppm (Sustained for 5 minutes)	• STOP WORK and notify PM • Investigate the cause of the elevated VOC measurements and identify measures to reduce concentrations (i.e. cover impacted soils, ventilation, etc.) • Work activities shall only continue once levels have decreased to or below 5 units above background. • If levels continue above 5 units, only individuals who are medically qualified to wear respiratory protection are permitted to continue work activities with Task Manager approval. • Don Level C PPE (organic vapor respirator cartridges), continue monitoring, and initiate continuous air monitoring for benzene
	> 25 ppm (Sustained for 5 minutes)	• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Volatile Organic Compounds (VOCs) and Volatile Hydrocarbons

Equipment/Instrument: Photo Ionization Detector (PID)

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity

Benzene

Equipment/Instrument: Photo Ionization Detector (PID) with benzene-specific separation tube

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously where indicated by VOC readings	≤ 0.25 ppm	• Continue monitoring • Continue work in the required PPE
	> 0.25 ppm	• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Hydrogen Sulfide (H_2S)

Equipment/Instrument: [Multi-Gas Detector or Individual H2S Monitor]

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously during tasks where exposure to hydrogen sulfide is possible	≤ 5 ppm	• Continue monitoring • Continue work in the required PPE
	> 5 ppm	• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Combustible Gas

Equipment/Instrument: Multi-Gas Detector

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously during tasks where exposure to combustible gases is possible	≤ 5% of LEL	• Continue monitoring • Continue work in the required PPE
	> 5% of LEL	• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Oxygen (O_2)

Equipment/Instrument: Multi-Gas Detector

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
	< 19.5%	Oxygen Deficient Atmosphere

Oxygen (O_2)

Equipment/Instrument: Multi-Gas Detector

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously during tasks where exposure to oxygen deficient or enriched atmosphere is possible		• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager
	19.5 – 23.5%	• Continue monitoring • Continue work in the required PPE
	> 23.5%	Oxygen Enriched Atmosphere • STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Carbon Monoxide (CO):

Equipment/Instrument: Multi-Gas Detector

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone, continuously during tasks where exposure to carbon monoxide is possible	≤ 10 ppm	• Continue monitoring • Continue work in the required PPE
	> 10 ppm	• STOP WORK and exit the work area or confined space • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Dusts (Not Otherwise Specified – Total by Aerosol Monitor)

Equipment/Instrument: Particulate Monitor

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone every 30 minutes during field activities where exposure to excessive dusts are possible	< 5 ppm	• Continue monitoring • Continue work in the required PPE
	5 – 10 ppm	• Upgrade to Level C (P100 respirator cartridges) • Implement dust suppression measures • Contact the Site Safety Officer, Site Supervisor and Task Manager
	> 10 ppm	• CEASE ACTIVITY • Implement more effective dust suppression measures, • Contact the Site Safety Officer, Site Supervisor, and Task Manager
Edge of Exclusion Zone, every 30 minutes during excavation activities	< 5 ppm	• Continue monitoring • Continue work in the required PPE
	≥ 5 ppm	• CEASE ACTIVITY • Contact the Site Safety Officer, Site Supervisor, and Task Manager

Facility-Specific Chemical Release

Equipment/Instrument: Client/Host Facility's Chemical Release System

Zone Location and Monitoring Interval	Response (Action) Level	Response Activity
Breathing zone within designated areas/buildings or site-wide, as appropriate for the facility/site	No Release(s) Detected	• Continue monitoring for facility alarms • Continue work in the required PPE
	Chemical Release Detected	• STOP WORK and immediately leave the area/building • Report to the designated muster location • Contact the Site Safety Officer, Site Supervisor and Task Manager • Wait for All-Clear to return to work area

10.0 PERSONAL PROTECTIVE EQUIPMENT

PPE is considered the last line of defense in hazard control. PPE is meant to protect workers when all other methods (elimination, engineering, and administrative) have been exhausted. All employees must be trained in the proper use and maintenance of PPE. See Procedure S3AM-208-PR, Personal Protective Equipment.

A PPE assessment (see S3AM-208-FM1) can be performed to help determine PPE requirements. PPE upgrades for individual tasks or steps of a task are to be identified in TRAs. Note: Flame Resistant (FR) Clothing or Coveralls may also be required as site minimum PPE by the host facility or process/operational area.

10.1.1 Site Minimum Personal Protective Equipment

Unless otherwise excluded by an approved Management of Change (MoC), the following personal protective equipment is required by AECOM procedures and requirements and shall be worn on site outside of designated as "Safe Zones", such as offices and parking lots.

Site Minimum PPE

■ Hard hat	■ Reflective safety vest or clothing
■ Safety glasses with side shields (may be clear or shaded)	■ Standard work gloves (i.e. leather, mechanics, or similar)
■ Long-sleeve shirt and pants or long-sleeve coveralls	■ Safety-toe work boots with 4-inch leather upper

10.1.2 Additional Personal Protective Equipment Needed on Site

The following PPE is required by the host facility, task hazard assessment (THA), or prescribed upgrades in response to air monitoring response (action) levels.

Head / Ears *(select all that apply)*

☐ Climbing helmet	☒ Earplugs
☐ Hard hat with chin strap	☐ Over-ear hearing protection (i.e. muffs)
☐ Wide brimmed hat	☐ Dual hearing protection (earplugs and muffs)
☐ Insect net	☐ Other: [specify]

Face / Eyes *(select all that apply)*

☐ Spoggles (Safety glasses with foam liner for dust protection)	☒ Face shield (impact)
☐ Chemical goggles	☐ Face shield (splash)
☐ Welding mask/goggles	☐ Other:

Hands *(select all that apply)*

☐ Abrasion, cut and/or puncture resistant	☒ Chemical resistant:
☐ Impact resistant	☒ Nitrile
☒ Leather	☐ PVC
☐ Mechanics	☐ Nitrile
☐ Other: [specify]	☐ Other: [specify]

Legs / Feet *(select all that apply)*

☐ High ankle boots	☐ Rubber boots
☐ Metatarsal guards	☐ Waders
☐ Electrically-resistant boots	☐ Snake gaiters or chaps
☐ Puncture-resistant boots or insoles	☐ Disposable boot covers or booties
☐ Other: [specify]	

Body *(select all that apply)*

☒ Sunscreen	☒ Personal flotation device (PFD): (when w/in 10 ft. of water)
☒ Insect repellent with DEET	☐ Type I ☒ Type II ☐ Type III
☐ Permethrin applied to clothing	☒ Type V – Auto-inflate with Type II performance
☒ Disposable coveralls	☐ Type V – Mustang Suit
☐ Flame Retardant Clothing (FRC):	☒ Fall Protection:
☐ Rating: [specify]	☐ Full body harness
☐ Weight: [specify]	☐ Single lanyard with self-locking D-ring
☐ Rating and weight not specified by client or facility	☐ Double lanyard with self-locking D-rings
☐ High-visibility clothing:	☐ Self-retracting life line with self-locking D-ring
☐ ANSI Class II	☐ Shock absorber
☐ ANSI Class III	☐ Lad-safe or similar device
☐ Not specified by client or facility	☐ Suspension trauma straps
☐ Other: [specify]	☐ Self-rescue kit
☐ Other: [specify]	☐ Other: [specify]

Respiratory Protection *(select all that apply)*

☐ Air-Purifying Respirator (APR):	☐ Filtering Facepiece Respirator (FFR) - Required Use
☐ Full-Face	☐ N95 ☐ N99 ☐ N100

Respiratory Protection *(select all that apply)*

☐ Half-Face	☐ R95	☐ R99	☐ R100
☐ Cartridge: [Specify]	☐ P95	☐ P99	☐ P100
☐ Supplied Air Respirator:	☐ Other: [Specify]		
☐ Self-Contained Breathing Apparatus (SCBA)	☒ FFR / Face Covering / Face Mask – Voluntary Use		
☐ Air-Line Respirator			

Equipment *(select all that apply)*

☒ Air and Noise Monitoring	☒ Weather, Heat and Cold Stress Monitoring:
☐ Dosimeter	☐ Portable weather station or meter
☒ See Section 8.4.3 above	☒ Smart phone with weather app
☐ Other: [specify]	☐ Wet Bulb Globe Thermometer (WBGT)
☐ Communication Beyond Cell Phones	☐ Other: [specify]
☐ Portable, hand-held radio	☐ Wildlife / Wilderness Survival:
☐ Satellite phone	☐ Air horn
☐ Other: [specify]	☐ Bear spray
☐ Traffic / Work Area Controls:	☐ Emergency Rations
☐ See Section 11.1	☐ Emergency Shelter(s)
☐ Other: [specify]	☐ Other: [specify]
☒ Fire Control / Protection:	☐ Other:
☒ 5-lb. ABC fire extinguisher; qty = 1/fleet vehicle)	☐ [specify]
☒ 10-lb. ABC fire extinguisher; qty= 1/aerial lift	☐ [specify]
☐ [specify]	☐ [specify]
☒ First Aid:	☐ [specify]
☒ ANSI Z308.1 (2015) Type III, Class A, Qty= 1	☐ [specify]
☐ Type [?], Class [?], Qty= [#]	☐ [specify]

11.0 SITE CONTROL

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

11.1 SITE WORK ZONES

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

- “Line of Fire” hazards- overhead utilities, falling/ tipping equipment, release of energy/ pressure, flying debris,
- Noise, dust, odor suppression

- Contamination containment and decontamination area layout
- Traffic control for site vehicles/ equipment (public traffic control requires Traffic control Plan)
- Restricted access for areas requiring special training, skills, or certifications
- Restriction of work near railroads
- Presence or creation of excavations
- Loading/unloading areas
- Portable restrooms
- Dumpsters and bins
- Equipment lay down
- Heavy equipment parking
- Overnight safety and security needs

Check the description of the site controls already in place:

☐ Work area is within a facility/property with secure and restricted access provided by client or third party
☒ Work area is enclosed within a facility/property, but access is not restricted via locks, guards, or gates
☐ Work area is on a property that is open, but access by the public is unlikely
☐ Work area is on a property that is open and access by the public is likely
☐ Work area is in a roadway or right-of-way of a roadway (Traffic Control Plan required; see S3AM-306-PR1)
☐ Work area is on or near railroad, including right-of-way, active lines and crossings; see S3AM-329-PR1
☐ Other: [Insert description]

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

Control Item	Description of Type and Application
☐ Fence	
☒ Locks	As needed to secure monitoring and sampling locations
☐ Barricades	
☒ Cones	As need to demarcate AECOM work areas
☐ Tape	
☐ Hole Covers	
☒ Other:	Field vehicle(s) will be positioned to separate the field crew from potential vehicular traffic

11.2 SIMULTANEOUS AND NEIGHBORING OPERATIONS

Simultaneous and neighboring operations (SIMOPS) present a need for added coordination and communication to address hazards that are presented by multiple operations. When SIMOP exist, a Person-in-Charge will be designated by the Task Manager to coordinate and sequence these activities. The hazards associated with these activities will be identified and eliminated, when practical, and/or mitigated to achieve a residual risk level that is as low as reasonably practical using the RM HITRA Process. SIMOPS anticipated listed in the table below and have been addressed with the hazards and control measures outlined within the Task Hazard Assessment(s) provide in

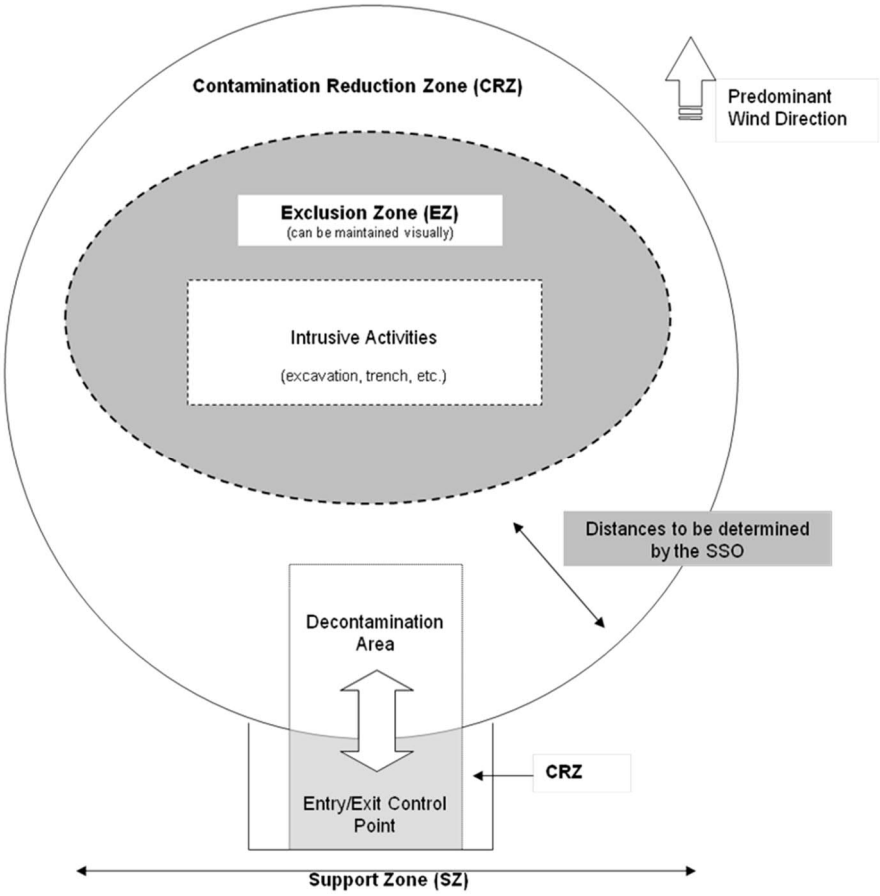
Attachment C. Unanticipated SIMOPS represent a 'STOP WORK' situation. Tasks impacted by the unanticipated SIMOPS shall not resume until the SIMOPs no longer exists or the SIMOPS has been addressed at the field level using the RM HITRA Process and field activities have been approved to resume by the Person-In-Charge.

Simultaneous Operations – Within the Site			☒ Yes, see table below for details ☐ None, not applicable		
Activity	Company	Contact Person (Activity Lead)	Contact's Phone Number	Addressed in THA(s)	
Vehicle Traffic	AJM Realty	Alex Sands	516-554-4410	☒ Yes	☐ No
				☐ Yes	☐ No
				☐ Yes	☐ No

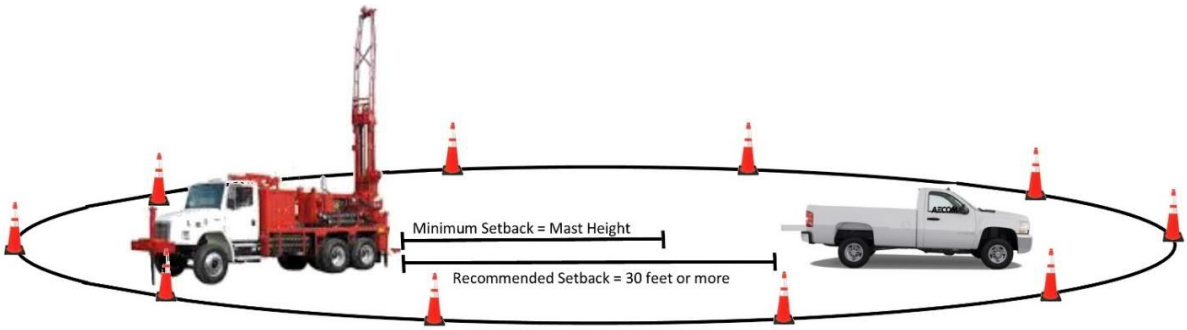
Simultaneous Operations – Neighboring Site			☐ Yes, see table below for details ☐ None, not applicable		
Activity	Company	Contact Person (Activity Lead)	Contact's Phone Number	Addressed in THA(s)	
				☐ Yes	☐ No
				☐ Yes	☐ No
				☐ Yes	☐ No

11.3 SITE CONTROL MAP/ DIAGRAM

11.3.1 Example Exclusion Zone Layout



11.3.2 Example Work Area Layout



11.4 SITE SECURITY

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

☐ Project site is located in a higher crime area or has a history of security incidents
☐ Work will be performed in areas outside of regular cellular telephone service
☐ Idle property with potential for trespasser(s) to shelter in buildings/structures and assault personnel
☐ Work will be performed at night (i.e. outside of daylight hours)

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

11.5 PROPERTY OWNER/HOST FACILITY-SPECIFIC SAFETY REQUIREMENTS

The property owner and/or host facility has specified no additional health and safety requirements that must be met while on site.

12.0 PERSONNEL ACKNOWLEDGEMENT

By signing below, the undersigned acknowledges that he/she has reviewed the AECOM Health and Safety Plan for the IPO US NY Columbia Cement site. The undersigned also acknowledges that he/she has been instructed in the contents of this document and understands the information pertaining to the specified work and will comply with the provisions contained therein. The employee understands that they are NOT to perform any work that they have not been adequately trained for or has not been risk assessed and that they are to stop work if it is unsafe to proceed. Finally, the employee understands to notify the Field Lead/Site Supervisor and the Incident Hotline at 1-800-348-5046 for any incident, *including ANY injury even if no first aid or medical treatment is required.*

Print Name	Signature	Company/Affiliation	Date

12.1 DISCLAIMER

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

13.0 SITE ORIENTATION RECORD FOR VISITORS

By signing below, the undersigned acknowledges that, as a visitor, he/she has received the Site Orientation for the IPO US NY Columbia Cement specific to their visit and will comply with site requirements and field crew instructions. The visitor understands that they are NOT to perform any work and may not enter any work area for which they do not have the requisite training, competency, and/or equipment, including personal protective equipment. Finally, the visitor understands to notify the Field Lead/Site Supervisor or Site Safety Officer of any incident, *including ANY injury even if no first aid or medical treatment is required.*

Print Name	Signature	Company/Affiliation	Date

13.1 DISCLAIMER

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

14.0 DOCUMENT REVISION RECORD

Issue No.	Issue Date	Details of Revisions
1	3/30/2016	None – Original Document
2	3/30/2017	Thirty-day extension
3	8/16/2017	Annual review and update; Update to new HASP template
4	3/13/2018	Updated SH&E Event Notification and Reporting Flows in Appendix A and Emergency Response Quick Reference Guide
5	8/9/2018	Annual Review
6	7/19/2019	Annual review. SOW updated to include installation of sub-slab depressurization system.
7	7/23/2021	Update to new template. SOW updated to include groundwater gauging.

Attachment A

AECOM SH&E Field Applicable Procedures

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

Programmatic procedures referenced in this document (for example SH&E Training) DO NOT need to be printed for inclusion in this HASP. Only procedures that are needed for field activity reference and application MUST be printed in full and included in this section.

Copy the Field Procedure Checklist from the Physical Hazards HASP Section 7.1 to become your table of contents for these attachments. Include only those procedures checked as applicable to this project.

AECOM Imagine it. Delivered.

Pandemic COVID-19 Vaccine Policy

Purpose

This policy defines AECOM's enterprise-wide approach to the expansion of existing COVID-19 health and safety programs to address vaccines.

Policy

AECOM is committed to the health and safety of our employees by supporting community uptake of approved COVID-19 vaccines as the most effective measure to end the current global pandemic.

Measures outlined in this policy are designed to keep our employees, clients, and communities safe from COVID-19, particularly the vulnerable or those in a high-risk category.

AECOM therefore strongly encourages, but does not require, all employees receive an approved vaccine when available and eligible. AECOM will continue to require all employees comply with best practices for COVID-19 health and safety during work time.

It is AECOM's expectation all employees treat each other with respect regardless of vaccine status and regardless of personal opinions about vaccines.

Working from the Office

- All employees will be required to abide by the local office Workplace Readiness Plan and associated signposted requirements, e.g., social distancing, spaced seating plans, mask use/face-covering, which may include guidelines linked to vaccine status.
- AECOM will continue to comply with applicable government guidance regarding safe practices for returning to work, e.g., CDC, WHO, local Health Department guidance. Where a conflict arises between such guidance, AECOM will follow the stricter guidance where feasible.

Client Interactions

- AECOM's support to clients through site visits and face-to-face meetings with stakeholders is critical to our business operations.
- In addition to local laws, employees are required to abide by any client specific COVID-19 health and safety requirements, which may include, in some cases, the provision of documentation establishing proof of immunization and/or proof of a suitable negative COVID-19 test.

Work-Related Travel

- AECOM will continue to comply with applicable government guidance on travel, including where restricted and/or quarantine periods must be observed.
- Employees traveling domestically for work are required to follow both travel-provider COVID-19 safety protocols and regional travel protocols, obtaining required approvals from a supervisor before travel.
- Employees asked to travel internationally must follow the same protocols as domestic travellers; however, AECOM may, where permitted by local law, require individuals also show proof of COVID-19 immunization as a pre-condition for approval regardless of whether this is a condition of that country. Where vaccines are not available or where employees have a reasonable accommodation or adjustment in place, a suitable negative COVID-19 test result must be obtained prior to any travel and/or return to office, and masks must be worn during all close contact activities.

Access to Vaccine Appointments

- AECOM will follow applicable laws where requirements exist.
- AECOM will provide flexibility to attend appointments.

Reasonable Accommodations or Adjustments

- Consistent with applicable law and policies, AECOM will evaluate and provide reasonable accommodations or adjustments for employees.
- Employees requesting such accommodation or adjustment should direct their requests to Human Resources.

Review and Communication

This policy is published in the Ecosystem IMS and will be reviewed regularly and updated as necessary

14-May-2021

Troy Rudd
Chief Executive Officer

Date

Daily Heat Illness Prevention Log

S3AM-113-FM2

Date: _____ Project: _____ Site Safety Officer: _____

☐ Light Workload ☐ Moderate Workload ☐ Heavy Workload ☐ Very Heavy Workload

ADJ. FORECASTED MORNING HIGH:_____

EXPECTED WORK REST CYCLE:_____
(USE CODE (0-SW) FROM TABLE)

ADJ. FORECASTED AFTERNOON HIGH:_____

EXPECTED WORK REST CYCLE:_____
(USE CODE (0-SW) FROM TABLE)

WORK REST CYCLE, Adjusted Temperature Method (see page 2)*

CODE	Work Rest Cycle
0	No specified requirements
1	15 minute break every 90 minutes of work
2	15 minute break every 60 minutes of work
3	15 minute break every 45 minutes of work
4	15 minute break every 30 minutes of work
5	15 minute break every 15 minutes of work
SW	Stop work

BREAK SCHEDULE

START TIME	END TIME	WATER CONSUMPTION	BREAK LOCATION

*FOR COMPLETION BY SSO FORECASTED TEMP + ADJUSTMENT FACTORS (SEE TABLE BELOW) = ADJUSTED TEMP

Morning High Calculation: _____ +_____ =_____

Afternoon High Calculation: _____ +_____ =_____

Time of Day	
Before daily temperature peak[1]	+2°F (+1.11°C)
10 am – 2 pm (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind (*ignore if indoors or wearing CPC*)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity (*ignore if wearing CPC*)	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative Humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)[2]	
Modified Level D (coveralls, no respirator)	+5°F (+2.78°C)
Miscellaneous	
Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

Apply the adjusted temperature to the below table given the anticipated Workload to determine the appropriate Work-Rest Regimen code.

Code	Work-Rest Regimen	Adjusted Temperature			
		Light Work	Moderate Work	Heavy Work	Very Heavy Work
0	No specified requirements	**< 80°F** (26.67°C)	**< 75°F** (23.88°C)	**< 70°F** (21.11°C)	**< 65°F** (18.33°C)
1	15 minute break every 90 minutes of work	**80°F – 90°F** (26.67 - 32.22°C)	**75 – 85°F** (23.88 - 29.44°C)	**70 – 80°F** (21.11 - 26.67°C)	**65 – 75°F** (18.33 - 23.88°C)
2	15 minute break every 60 minutes of work	**>90 – 100°F** (32.22 - 37.77°C)	**> 85 – 95°F** (29.44 - 35°C)	**>80 – 85°F** (26.67 - 29.44°C)	**>75 – 80°F** (23.88 - 26.67°C)
3	15 minute break every 45 minutes of work	**>100 – 110°F** (37.77 - 43.33°C)	**>95 – 100°F** (35 - 37.77°C)	**>85 – 90°F** (29.44 - 32.22°C)	**>80 – 85°F** (26.67 - 29.44°C)
4	15 minute break every 30 minutes of work	**>110 – 115°F** (43.33 - 46.11°C)	**>100 – 105°F** (37.77 – 40.55°C)	**>90 – 95°F** (32.22 - 35°C)	**>85 – 90°F** (29.44 - 32.22°C)
5	15 minute break every 15 minutes of work	**>115 – 120°F** (46.11 - 48.88°C)	**>105 – 110°F** (40.55 - 43.33°C)	**>95 -100°F** (35 - 37.77°C)	**>90 – 95°F** (32.22 - 35°C)
SW	**Stop Work**	**>120°F** (48.88°C)	**>110°F** (43.33°C)	**>100°F** (37.77°C)	**>95°F** (35°C)

°F = degrees Fahrenheit °C = degrees Celsius

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

[2] Refer to S3AM-113-ATT1 for addition Chemical Protective Clothing (Type C – A)

****Attach copy of receipts for water purchases**

Daily Heat Illness Prevention Log

S3AM-113-FM2

Date: _____ Project: _____ Site Safety Officer: _____

☐ Light Workload ☐ Moderate Workload ☐ Heavy Workload ☐ Very Heavy Workload

ADJ. FORECASTED MORNING HIGH:_____

EXPECTED WORK REST CYCLE:_____
(USE CODE (0-SW) FROM TABLE)

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BREAK SCHEDULE

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Wind (*ignore if indoors or wearing CPC*)	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
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Miscellaneous	
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SW	**Stop Work**	**>120°F** (48.88°C)	**>110°F** (43.33°C)	**>100°F** (37.77°C)	**>95°F** (35°C)

°F = degrees Fahrenheit °C = degrees Celsius

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

[2] Refer to S3AM-113-ATT1 for addition Chemical Protective Clothing (Type C – A)

****Attach copy of receipts for water purchases**

Americas

Temperature Thresholds

S3AM-112-ATT1

1.0 Purpose and Scope

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

Table 1. Wind Chill Chart (C)

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

Note: A. Little Danger: if less than one hour of exposure to dry skin.
B. Danger: Exposed flesh freezes within one minute.
C. Great Danger: Flesh may freeze within 30 seconds.

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

Table 2. Equivalent Chill Temperature Chart (F)

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

1.2 How fast a person's body cools in cold weather depends on: air temperature, wind speed, heat of the sun, and work being done.

1.2.1 The following Table 3 provides guidelines for establishing periods of work to warming break periods based on ambient temperature and wind speed for workers wearing dry clothing.

1.2.2 Notes following the Table take into account additional factor such as physical exertion, whether workers are acclimatized, etc.

Table 3. Work-Warming Schedule Guidelines

Air Temp. (Sunny Sky) °F	No Noticeable Wind		5 mph Wind (8 km/h)		10 mph Wind (16 km/h)		15 mph Wind (24 km/h)		20 mph Wind (32 km/h)		25 mph Wind (40 km/h)		Air Temp. (Sunny Sky) °C
	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	Max. Work Period	Breaks	
above 5°	Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		Normal Work Schedule		above -15°
5° to -1°											100 min	2	-15° to -17°
0° to -4°									100 min	2	75 min	2	-18° to -20°
-5° to -9°							100 min	2	75 min	2	55 min	3	-21° to -22°
-10° to -14°					100 min	2	75 min	2	55 min	3	40 min	4	-23° to -25°
-15° to -19°			100 min	2	75 min	2	55 min	3	40 min	4	30 min	5	-26° to -28°
-20° to -24°	100 min	2	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work		-29° to -31°
-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Cease Work				-32° to -34°
-30° to -34°	55 min	3	40 min	4	30 min	5	Cease Work						-35° to -37°
-35° to -39°	40 min	4	30 min	5	Cease Work								-38° to -39°
-40° to -44°	30 min	5	Cease Work										-40° to -42°
-44° & below	Cease Work												-43° & below

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

Note 1: Schedule describes the maximum continuous duration of work and number of 10-15 minute breaks to be observed during any 4-hour work period and assumes that period will be followed by an extended warm-up period (e.g., lunch). Allowed breaks should be taken in a warm environment.

Note 2: Schedule applies to moderate to heavy work performed by acclimated workers wearing appropriate layered clothing. For light to moderate work apply the schedule for conditions one step lower. For unacclimated workers apply the schedule for conditions two steps lower. These modifications are additive.

Note 3: For work under 25%–50% overcast/clouds, apply the schedule for conditions one step lower. For work at night or under greater than 50% overcast/clouds, apply the schedule for conditions two steps lower. These modifications are additive with any applicable modifications from Note 2.

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

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

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

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

- A 5 mph (8 km/h) wind will move a light flag
- A 10 mph (16 km/h) wind will fully extend the flag
- A 15 mph (24 km/h) wind will raise a newspaper sheet
- A 20 mph (32 km/h) wind will produce blowing and drifting snow.

Symptoms & Treatment

1.0 Cold Stress-related Illnesses

1.1 Frostbite

1.1.1 Frostbite is a localized cold injury characterized by freezing of the tissues with ice crystal formation. There are several degrees of damage. Frostbite can be categorized into:

- **Frost Nip or Initial Frostbite**: (1st degree frostbite) Characterized by blanching or whitening of skin.
- **Superficial Frostbite**: (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.
- **Deep Frostbite**: (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.

1.1.2 Frostbite injury is almost always limited to the upper and lower extremities (finger and toes) or to such appendages as the ears, nose or cheeks.

1.1.3 Conditions conducive to frostbite include sub-zero temperatures, hypothermia, dehydration, obstruction of the blood supply to the extremities (by constricting clothing, especially on the feet or at the wrists or ankles), contact with cold metal, contact with organic liquids (such as gasoline or solvents that have been left outdoors in sub-zero temperatures), use of substances that cause vasoconstriction (such as smoking tobacco), or other injury or shock.

1.1.4 Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues.

1.1.5 Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.

1.1.6 The first symptom of frostbite is an uncomfortable sensation of coldness and pain, followed by numbness. There may be tingling, stinging, or cramping. Ongoing symptoms of frostbite include:

- Sudden and complete cessation of cold or discomfort in affected fingers or toes, often followed by a pleasant feeling of warmth;
- Subsequently the only symptom may be the absence of any sensation in the frozen part;
- Paleness in the affected tissues;
- Firm or hard tissues; and
- Purple tissue, if a large area, such as an entire hand or food, is frostbitten.

1.1.7 If exposure occurs in temperatures that are below freezing (32ºF or below), frostbite or trench foot (immersion foot) may accompany or complicate the symptoms of hypothermia. Frostbite is the freezing of living tissues with a resultant breakdown of cell structure. Symptoms due to frostbite may include, but is not limited to:

- Superficial redness of the skin;
- Slight numbness;
- Blisters;
- Obstruction of blood flow (ischemia);
- Blood clots (thrombosis); and
- Skin discoloration due to insufficient oxygen in the blood (cyanosis).

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

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

1.2 Hypothermia

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

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

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

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

1.2.3 Early warning signs of hypothermia:

- Feeling of being cold and tired;
- Heavier breathing and increased pulse rate;
- Tendency to keep moving (e.g., stamping feet, rubbing hands, continued walking/pacing);
- Goose bumps, holding arms tightly wrapped around the body, hunching of shoulders, and
- Shivering.

1.2.4 Hypothermia damages both the body's internal temperature mechanisms (hypothalamus) and the peripheral mechanisms to prevent heat loss (vasoconstriction and perspiration.) These effects may last up to three years after the initial hypothermia episode. Symptoms of hypothermia may include, but are not limited to:

- Pain in the extremities;
- Severe shivering and numbness;
- Low core body temperature;
- Drowsiness and muscular weakness;
- Apathy;
- Mental confusion;
- Loss of consciousness;
- Shock, and
- Decreasing pulse and breathing rate.

2.0 Recommended Treatment for Cold Stress-related Illnesses

2.1 Frostbite

2.1.1 Wrap the victim in woollen blanket and keep dry until he or she can be brought inside.

2.1.2 Remove the victim from the cold environment.

2.1.3 Do not rub, chafe, or manipulate frozen parts.

2.1.4 Place the victim in warm water (102ºF to 105ºF) and make sure the water remains warm. Test the water by pouring it on the inner surface of your forearm. Never thaw affected body parts if the victim has to go back out into the cold; refreezing can cause significant tissue damage.

2.1.5 Do not use hot water bottles or a heat lamp, and do not place the victim near a hot stove.

2.1.6 Do not allow the victim to walk if his or her feet are affected.

2.1.7 Have the victim gently exercise the affected parts once they are thawed.

2.1.8 Seek immediate medical attention for thawing of serious frostbite.

2.2 Hypothermia

2.2.1 Bring the victim into a warm room or shelter as quickly as possible.

2.2.2 Give artificial respiration and stop any bleeding, if necessary.

2.2.3 If the victim cannot be moved (spinal injury, etc.), carefully place newspapers, blankets, or some other insulation between the victim and the ground.

2.2.4 Remove all wet clothing.

2.2.5 Provide an external heat source, because the body cannot generate its own heat. Wrap the victim in prewarmed blankets, place him or her in the liner of a portable hypothermia treatment unit, put the torso (not the extremities) into a tub of warm water, or use body-to-body contact to rewarm the body core. These measures will slowly reopen the peripheral circulation, minimizing the possibility

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

2.2.6 Do not allow the victim to sleep.

2.2.7 Give warm, sweet drinks. Do not give alcohol or pain relievers.

2.2.8 Keep the victim still. Do not try to walk.

2.2.9 Do not rub numb skin.

2.2.10 Get medical attention as soon as possible.

Americas

Cold Stress

S3AM-112-PR1

1.0 Purpose and Scope

1.1 To protect employees from the severest effects of cold stress (hypothermia) and cold injury and to identify exposures to cold working conditions under which it is believed nearly all employees can be repeatedly exposed without adverse health effects.

1.2 This procedure applies to all AECOM Americas based employees and operations, and any other entity and its personnel contractually required to comply with this document's content, working outdoors in damp and cool (below 50 degrees Fahrenheit [°F] or 10 degrees Celsius [°C]) conditions or anytime temperatures are below 32°F or 0°C.

2.0 Terms and Definitions

2.1 **Cold Stress** – The production of physiological effects due to cold temperatures and\or wind chill.

2.2 **Equivalent Chill Temperature (ECT)** – Also known as Wind Chill (see below).

2.3 **Frostnip** – Superficial cooling of tissues without cellular destruction.

2.4 **Frostbite –** Freezing of tissue, resulting in tissue destruction.

2.5 **Hypothermia –** Condition of reduced core body temperature to 95ºF (35ºC) resulting in loss of dexterity, loss of mental alertness, collapse, and possible death.

2.6 **Wind Chill –** The combined effect of air temperature and wind. Also expressed as "equivalent chill temperature" (ECT), wind chill is defined as heat loss resulting from the effects of air temperature and wind velocity upon exposed skin.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-128-PR1 Medical Screening & Surveillance Program

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-314-PR1 Working Alone

3.5 S3AM-315-PR1 Working On or Near Water

3.6 S3AM-333-PR1 Marine Safety & Vessel Operations

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

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

- Confirm employees are properly trained to recognize the symptoms of cold stress.

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

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

4.1.3 **Supervisor**

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

4.1.4 **Employee**

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

4.2 Requirements

4.2.1 Carefully plan work anticipated to be performed in cool or cold conditions. If possible, heavy work should be scheduled during the warmer parts of the day or when the wind is most calm. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.

4.2.2 Staff working in extreme cold (wind chill or ECT below 10ºF or -12ºC) shall not work alone. The Buddy System shall be utilized to keep an eye on each other and to watch for signs of cold stress. Refer to *S3AM-314-PR1 Working Alone*. Watch for symptoms and signs of hypothermia

4.2.3 Monitor weather forecasts and weather conditions such as ambient temperature, wind speed, and precipitation. Use observations prior to entering and while in the field to ensure appropriate protections are in place:

- If possible, move the work to a warm location.
- If possible and as applicable, erect shelters or screens around the work area.
- If possible, heat the work area.
- If possible, adjust schedule according to the cold conditions, work level and worker acclimatization.
- Implement a work-warming regimen by taking breaks out of the cold. As applicable, consult *S3AM-112 ATT1 Temperature Thresholds* to determine wind chill and work-warming schedule.
- Take frequent short breaks in warm dry shelters to allow your body to warm up. Limit time of exposure to the cold. If shelter is not readily available, consider supplying temporary shelters.

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

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

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

4.3 Training

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

4.3.1 Sources of cold stress, the influence of protective clothing, and the importance of acclimatization.

4.3.2 How the body loses heat.

4.3.3 Recognition of cold-related illness symptoms.

4.3.4 Cold stress preventative/corrective measures including, but not limited to:

- Weather monitoring.
- Proper eating and drinking practices.
- Work-warming schedules and proper re-warming techniques.
- Buddy system.
- Safe cold work practices appropriate to the work that is to be performed.
- Proper use of cold environment personal protective clothing.

4.3.5 The harmful effects of excessive alcohol consumption in a cold stress environment.

4.3.6 The hazards associated with unstable snow or ice build ups.

4.3.7 First aid procedures for symptoms related to cold stress.

4.4 Personal Protective Equipment (PPE)

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

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

4.4.1 Wear at least 3 layers of clothing to help prevent cold stress. It is important to preserve the air space between the body and the outer layer of clothing to retain body heat.

- Wear a middle layer of down, wool, or similar materials to provide insulation.
- Avoid cotton, especially blue jeans.
- Wear an outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
- Do not wear tight clothing. Loose clothing allows better ventilation.

4.4.2 Wear proper clothing, including head coverings and gloves or mittens for cold, wet, and windy conditions.

4.4.3 Wear a hat or hardhat liner. Up to 40 percent of body heat can be lost when the head is left exposed.

4.4.4 Use insulated footwear with adequate traction to prevent slips and falls.

4.4.5 Wear insulated boots or other insulated footwear, and insulated gloves to help reduce the chance of frostbite.

4.4.6 Keep a change of dry clothing available in case work clothes become wet.

4.4.7 Eye and face protection for employees employed outdoors in a snow and/or ice-covered terrain should be supplied.

- Sunglasses (with UVA and UVB protection) and sunscreen should be used when there is a persistent combination of snow and direct sun.
- Special safety goggles to protect against blowing ice crystals and ultraviolet light and glare (which can produce temporary conjunctivitis and/or temporary loss of vision) should be required when there is an expanse of snow coverage causing a potential eye exposure hazard.
- Ensure face guards are used to protect skin in cold, windy conditions, including riding on an unshielded vehicle.

4.5 General Cold Stress Prevention Measures

4.5.1 In order to prevent hypothermia:

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

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

4.5.2 In order to prevent frost bite:

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

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

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

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

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

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

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

4.5.9 Operation of internal combustion or similar devices within warming shelters is prohibited.

4.5.10 If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

4.5.11 Walking and working surfaces shall be cleared of ice and snow to prevent slips and falls.

4.5.12 Confirm that employees carry fire starter materials if working in remote areas.

4.5.13 Supplies such as PPE, fuels, enclosures, de-icing, traction aids, warm drinks, and batteries will be specified by the SH&E Manager and/or the Manager and made available. These supplies will be inspected at least weekly during cold weather projects and replaced when necessary.

4.6 Cold Stress Prevention Measures for the Hands

4.6.1 Special protection of the hands is required to maintain manual dexterity for the prevention of accidents including, but not limited to the following:

- If fine work is to be performed with bare hands for more than 10 to 20 minutes in an environment below 60ºF (15ºC), special provisions should be established for keeping the employees' hands warm. For this purpose, warm air jets, radiant heaters (fuel burner or electric radiator), or contact warm plates may be utilized. Metal handles of tools and control bars should be covered by thermal insulating material at temperatures below 30ºF (-1º C).
- If the air temperature falls below 60ºF (15ºC) for sedentary work, 40ºF (4.4º C) for light work, or 20ºF (-6ºC) for moderate work, and fine manual dexterity is not required, employees should use gloves.

4.6.2 To prevent contact frostbite, employees should wear anti-contact gloves:

- When cold surfaces below 20°F (-6°C) are within reach, each employee should be warned to prevent inadvertent contact by bare skin.
- If the air temperature is 0°F (-18°C) or less, employees should protect their hands with mittens or appropriate gloves. Machine controls and tools for use in cold conditions should be designed so that they can be handled without removing the mittens or gloves.
- Ensure an adequate supply of dry gloves is available to replace wet gloves.

4.6.3 Provisions for additional total body protection are required if work is performed in an environment at or below 40ºF (4.4ºC). The employees should wear cold protective clothing appropriate for the level of cold and physical activity.

4.6.4 Additional Cold Stress Prevention Measures:

For work practices at or below 10ºF (-12ºC) ECT, the following will apply:

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

4.6.5 Employees handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 40ºF should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling. Special note should be taken of the particularly acute effects of splashes of “cryogenic fluids” or those liquids with a boiling point that is just above ambient temperature.

4.6.6 Trauma sustained in freezing or subzero conditions requires special attention, because an injured employee is predisposed to cold injury. Special provisions should be made to prevent hypothermia and freezing of damaged tissue in addition to providing for first aid treatment.

4.7 Hypothermia in Water

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

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

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

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

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

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

4.8 Work-Warming Regimen

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

4.8.2 The onset of heavy shivering, minor frostbite (frostnip), the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter.

4.8.3 When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing should be loosened to permit sweat evaporation or a change of dry work clothing provided.

4.8.4 A change of dry work clothing should be provided as necessary to prevent employees from returning to the cold environment with wet clothing.

5.0 Records

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

6.0 Attachments

6.1 S3AM-112-ATT1 Temperature Thresholds

6.2 S3AM-112-ATT2 Symptoms & Treatment

Americas

Heat Stress – Temperature Thresholds

S3AM-113-ATT1

1.0 Work-Rest Schedule

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

1.1 Establishing a Work-Rest Schedule:

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

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

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

1.2 WBGT Work-Rest Schedule Guidelines:

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

- Continue to monitor ambient conditions with the WBGT. However, if there are reports of the symptoms of heat-related disorders, then the analysis of little risk should be reconsidered.
- If the measured WBGT is greater than the values in the following two tables, institute heat stress controls, including the associated work-rest cycle, and perform physiological monitoring as described in *S3AM-113-PR1 Heat Stress*.
- Because of the physiological strain associated with very heavy work among less fit workers regardless of WBGT, values are not provided in Table 1 or 2 for continuous work or 75% work – 25% rest regimen. Physiological monitoring should always be implemented under these conditions.

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

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

Table 1. Non-CPC Activities WBGT Chart

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

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

Table 2. CPC Activities WBGT Chart

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

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

1.3 Humidex Based Work-Rest Schedule Guidelines

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

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

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

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

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

Heat Index Adjustment Table

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

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

Heat Index Response Plan*

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

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

1.4 Adjusted Temperature Work-Rest Schedule Guidelines:

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

Table 3. Temperature Adjustment Factors

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

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

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

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

Table 4. Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Regimen	Adjusted Temperature			
	Light Work	**Moderate Work**	**Heavy Work**	**Very Heavy Work**
No specified requirements	< 80°F (26.67°C)	< 75 (23.88°C)	< 70 (21.11°C)	< 65 (18.33°C)
15 minute break every 90 minutes of work	80°F – 90°F (26.67°C) - (32.22°C)	75 – 85 (23.88°C) - (29.44°C)	70 – 80 (21.11°C) - (26.67°C)	65 – 75 (18.33°C) - (23.88°C)
15 minute break every 60 minutes of work	>90 – 100 (32.22°C) - (37.77°C)	> 85 – 95 (29.44°C) - (35°C)	>80 – 85 (26.67°C) - (29.44°C)	>75 – 80 (23.88°C) - (26.67°C)
15 minute break every 45 minutes of work	>100 – 110 (37.77°C) - (43.33°C)	>95 – 100 (35°C) - (37.77°C)	>85 – 90 (29.44°C) - (32.22°C)	>80 – 85 (26.67°C) - (29.44°C)
15 minute break every 30 minutes of work	>110 – 115 (43.33°C) - (46.11°C)	>100 – 105 (37.77°C) – (40.55°C)	>90 – 95 (32.22°C) - (35°C)	>85 – 90 (29.44°C) - (32.22°C)
15 minute break every 15 minutes of work	>115 – 120 (46.11°C) - (48.88°C)	>105 – 110 (40.55°C) - (43.33°C)	>95 -100 (35°C) - (37.77°C)	>90 – 95 (32.22°C) - (35°C)
Stop Work	**>120** (48.88°C)	**>110** (43.33°C)	**>100** (37.77°C)	**>95** (35°C)

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

Work-rest schedules and water provisioning may be documented using logs such *as S3AM-113-FM2 Daily Heat Illness Prevention Log*.

Americas

Heat Stress – Symptoms & Treatment

S3AM-113-ATT2

1.0 Heat Illness Symptoms

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

1.1.1 Heat Rash

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

1.1.2 Heat Cramps

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

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

1.1.3 Heat Exhaustion

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

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

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

1.1.4 Heat Stroke

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

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

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

2.0 Recommended Treatment for Heat Stress-related Illnesses

2.1 Heat Rash

2.1.1 Treatment for heat rash includes:

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

2.2 Heat Cramps

2.2.1 Treatment for heat cramps includes:

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

2.3 Heat Exhaustion

2.3.1 Treatment of heat exhaustion includes:

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

2.4 Heat Stroke

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

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

Americas

Dehydration Chart

S3AM-113-ATT3

GUIDANCE TOOL FOR MONITORING DEHYDRATION

URINE COLORATION CHART

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

PREVENTING DEHYDRATION

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

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

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Heat Stress Monitoring Log

S3AM-113-FM1

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

Project Name:					**Foreman/Supervisor:**						**Work/Rest Schedule1:** IN *(min)* OUT *(min)*					
Date:	**Water Provided[1]**		**Acclimated[2]**		**Initial Vitals[3]**	**Vital Signs and Time In/Out[3]** **Celcius** ☐ **/ Farenheit** ☐ (select one)										
Employee Name	Yes	No	Yes	No	**Vitals**	In (P_1)	Out (P_1)	**Vitals**	In (P_1)	Out (P_1)	**Vitals**	In (P_1)	Out (P_1)	**Vitals**	In (P_1)	Out (P_1)
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		
					P			**P**			**P**			**P**		
					BP			**BP**			**BP**			**BP**		
					Temp			**Temp**			**Temp**			**Temp**		

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

Americas

Heat Stress

S3AM-113-PR1

1.0 Purpose and Scope

1.1 Establishes a Heat Illness Prevention Program to guide employees in preventing heat illness, recognition of the symptoms of heat stress-related illnesses and in taking the appropriate corrective action.

1.2 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 **Acclimated –** Employees who have developed physiological adaptation to hot environments characterized by increased sweating efficiency, circulation stability, and tolerance of high temperatures without stress. Acclimatization occurs after 7 to 10 consecutive days of exposure to heat and much of its benefit may be lost if exposure to hot environments is discontinued for a week.

2.2 **Chemical Protective Clothing (CPC)** – Apparel that is constructed of relatively impermeable materials intended to act as a barrier to physical contact of the Employee with potentially hazardous materials in the workplace. Such materials include Tyvek® coveralls (all types) and polyvinyl chloride coveralls and rain suits.

2.3 **Heat Cramps** – A form of heat stress brought on by profuse sweating and the resultant loss of salt from the body.

2.4 **Heat Exhaustion** – A form of heat stress brought about by the pooling of blood in the vessels of the skin and in the extremities.

2.5 **Heat Rash** – A heat-induced condition characterized by a red, bumpy rash with severe itching.

2.6 **Heat Stress** – The combination of environmental and physical work factors that constitute the total heat load imposed on the body.

2.7 **Heat Stroke** – The most serious form of heat stress, which involves a profound disturbance of the body's heat-regulating mechanism.

2.8 **Sunburn** – Caused by unprotected exposure to ultraviolet radiation present in sunlight that is damaging to the skin (Refer to *S3AM-121-PR1 Non-Ionizing Radiation*). The injury is characterized by red painful skin, blisters, and/or peeling.

2.9 **Unacclimated** – Employees who have not been exposed to hot work conditions for one week or more or who have become heat-intolerant due to illness or other reasons.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-010-PR1 Emergency Response Planning

3.4 S3AM-121-PR1 Non-Ionizing Radiation

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedures

4.1 Roles and Responsibilities

4.1.1 Managers

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

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

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

4.1.3 Supervisor

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

4.1.4 Employee

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

4.2 Restrictions

4.2.1 The Buddy System is required when working in high heat conditions; Employees shall not work alone.

4.2.2 Employees shall not be exposed to levels exceeding those specified for the given work level and work-rest regimen as listed in *S3AM-113-ATT1 Heat Stress – Temperature Thresholds*.

4.2.3 Clothing corrections shall be applied in accordance with the tables provided in *S3AM-113-ATT1 Heat Stress – Temperature Thresholds*.

4.3 Exposure Controls

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

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

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

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

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

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

4.4 Heat Stress Planning

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

4.4.2 The project and site-specific heat related risks shall be identified. Appropriate prevention and control measures shall be developed and documented in the project's SH&E Plan or included as a supplement to the SH&E Plan (e.g., *S4[DCS]AM-113-FM1 Heat Illness Prevention Plan – DCS Americas*) and the Task Hazard Assessments (THA). Refer to the *S3AM-209-PR1 Risk Assessment & Management* procedure.

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

contribution to heat stress. Because WBGT is only an index of the environment, the contributions of work demands, clothing, and state of acclimatization shall also be accounted for, as described in the following steps.

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

Table 1
Examples of Activities within Workload Categories

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

- Determine the approximate proportion of work within an hour during a typical shift. Typically, the initial work schedule will be 60 minutes of work per hour (100 percent work) with a small break in the morning and afternoon, as appropriate, and a 30-minute lunch break mid-day.
- For workers wearing cloth coveralls (e.g., Nomex fire resistant clothing), add 3 to the measured WBGT. For impermeable clothing, such as Tyvek or Saranex, the WBGT procedures cannot be used. For these situations, workers should begin physiological monitoring as soon as the temperature in the work area exceeds 70ºF (21°C).
- Use the collected information to develop appropriate work to rest schedules as detailed in *S3AM-113-ATT1 Heat Stress – Temperature Threshold*. Work-rest schedules and water provision shall be documented in the applicable SH&E Plan or supplementary Health Illness Prevention Plan and may be additionally documented using logs such *as S3AM-113-FM2 Daily Heat Illness Prevention Log*.

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

- This is the process by which the body "gets used to" hot work environments. This is achieved by slowly increasing workloads.
- New and returning Employees (absent one week or more) who have not had time to acclimatize may be more susceptible to heat related illnesses, even in seemingly low risk heat exposures.
- All Employees shall be allowed time to acclimatize in the event of a heat wave. All Employees assigned to a new process with additional heat exposures shall be allowed to acclimatize.
- Minimize workload and gradually increase as tolerance is built up. Allow for more frequent breaks.
- While acclimatization normally takes approximately 5 to 7 days, heightened monitoring of these Employees will be maintained for the first 14 days.

4.4.5 Employees shall be instructed in the recognition of heat stress symptoms, the first aid treatment procedures for severe heat stress, and the prevention of heat stress injuries. Employees shall be encouraged to immediately report any heat stress that they may experience or observe in fellow Employees. Supervisors shall use such information to adjust the work-rest schedule to accommodate such problems.

4.4.6 Wherever possible, a designated break area should be established in an air-conditioned space, or in shaded areas where air conditioning is impractical. The break area should be equipped to allow Employees to loosen or remove protective clothing, and sufficient seating should be available for all Employees. During breaks, Employees shall be encouraged to drink plenty of water or other liquids, even if not thirsty, to replace lost fluids and to help cool off. Cool water should be available at all times in the break area, and in the work area itself unless hygiene/chemical exposure issues prevent it.

4.5 Symptoms and Treatment

4.5.1 Refer to *S3AM-113-ATT2 Heat Stress – Symptoms & Treatment*.

4.5.2 Employees who exhibit ANY signs of significant heat stress (e.g., profuse sweating, confusion and irritability, pale, clammy skin) shall be relieved of all duties at once, made to rest in a cool location, and provided with large amounts of cool water.

4.5.3 Severe heat stress (heat stroke) is a life-threatening condition requiring immediate emergency medical care (e.g., call 911). Anyone exhibiting symptoms of heat stroke (slurred speech, unconsciousness, etc.) shall be taken immediately to the nearest medical facility. Steps shall be taken to cool the person during transportation (clothing removal, wet the skin, air conditioning, etc.).

4.6 Prevention

4.6.1 Requirements for working in extreme heat may be triggered by regulatory established criteria (e.g. CAL/OSHA requires high heat procedures when temperature equals or exceeds 95°F) or as a result of a hazard analysis assessing various contributory factors (refer to *S3AM-113-ATT1 Heat Stress – Temperature Thresholds*). Employees working in extreme heat or sun should understand and apply the following guidelines for preventing and detecting heat exhaustion and heat stroke.

- When possible, begin hydrating at least three days prior to working in high heat conditions.
- Review the heat stress exposure control plan within the SH&E Plan, and/or Task Hazard Analysis.
- If the supervisor is not immediately available confirm a reliable method of communication is in place to allow for contact with supervision. In the absence of cellular reception, a satellite phone or similar device may be required.

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

4.6.2 Personal Protective Equipment

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

4.7 Work-Rest Schedule Practices

4.7.1 Intake of fluid will be increased beyond that which satisfies thirst, and it is important to avoid "fluid debt," which will not be made up as long as the individual is sweating.

- Two 8-ounce glasses of water should be taken prior to beginning work, then up to 32 ounces (1 quart) per hour during the work shift; fluid replacement at frequent intervals is most effective.
- The best fluid to drink is water; liquids like coffee or soda do not provide efficient hydration and may increase loss of water.
- If commercial electrolyte drinks (e.g., Gatorade) are used, the drink should be diluted with water, or 8 ounces of water should be taken with each 8 ounces of electrolyte beverage.

4.7.2 Additional salt is usually not needed and salt tablets should not be taken.

4.7.3 Fluids for drinking should be cool and fresh, but not cold.

4.7.4 Breaks will be taken in a cool, shaded location, and any impermeable clothing should be opened or removed.

- A relatively cool, shaded area shall be provided for breaks when working in hot environments. For hazardous waste sites, the rest area should be located in the support zone adjacent to the contamination reduction zone, situated so that part of it is in the decontamination area so workers can take breaks without going through full decontamination.

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

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

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

4.7.7 Other controls that may be used include:

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

4.8 Evaluating the Work-Rest Schedule's Effectiveness

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

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

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

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

- The work period may be increased (generally, by 5- to 10-minutes intervals, up to a maximum of 4 hours) if the results of the first 2 hours of the physiological monitoring and the workers' self-assessments indicate that workers are recovering adequately (see below), and on the judgment of the SH&E Manager.
- The work period shall be decreased if the results of the physiological monitoring and the workers' self-assessment indicate that workers are NOT recovering adequately (see below).

4.8.4 If physiological monitoring is conducted, the Employee and/or the SH&E Manager (or appropriate designate) shall measure and record body temperature and pulse rate as described below.

4.8.5 Monitor body temperature to determine if Employees are adequately dissipating heat build-up. Ear probe thermometers which are adjusted to oral temperature (aural temperature) are convenient and the preferred method of measurement. Determine work/rest regimen as follows:

- Measure oral body temperature at the end of the work period. Oral body temperatures are to be obtained prior to the employee drinking water or other fluids.
- If temperature exceeds 99.6°F (37.5°C), shorten the following work period by 1/3 without changing the rest period.
- If, at the next rest period, temperature still exceeds 99.6°F (37.5°C), the worker should not be allowed to continue work until repeated temperature measurements are in the acceptable range (i.e., less than 99.6°F). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.
- Do not allow a worker to wear impermeable PPE when his/her oral temperature exceeds 100.6°F (38.1°C).

4.8.6 At the start of the workday each Employee's baseline pulse rate (in beats per minute [bpm]) is determined by taking a pulse count for 15 seconds and multiplying the result by four or by using an automated pulse count device. Pulse rates can then be measured at the beginning of each break period and two minutes thereafter to determine if the rest period allows for adequate recovery.

- Take the radial (wrist) pulse as early as possible in the rest period and determine the worker's heart rate in beats per minute. The heart rate is determined by counting the pulse for ten seconds and multiplying the number by 6 to get the beats per minute. Record this as P1.
- Wait 2 minutes and repeat the pulse measurement. Record this as P2.
- If P1 is greater than or equal to 110 beats per minute (bpm) and if (P1 – P2) is less than or equal to 10 bpm (indicating that workers are not recovering adequately), shorten the next work cycle by 1/3 without changing the rest period.
- At the next rest period, if P1 is still equal to or greater than 110 bpm, and if (P1 – P2) is still less than or equal to 10 bpm, shorten the following work cycle by 1/3 without changing the rest period.
- At the third rest period, if P1 is still equal to or greater than 110 bpm and (P1 – P2) is still less than or equal to 10 bpm, the worker should not be allowed to continue work until repeated pulse measurements are in the acceptable range (i.e., P1 is less than 110 bpm and (P1 – P2) is greater than 10 bpm). Do not leave the worker alone during the recovery time. Watch for signs of heat illness and be prepared to implement emergency response as necessary.

4.8.7 Use of an automated or similar blood pressure device will be used to assess each Employee's blood pressure at the beginning and end of each break period to determine if the rest period allows adequate cooling by applying the following criteria:

- If the blood pressure of an Employee is outside of 90/60 to 150/90, then the Employee will not be allowed to begin or resume work; extend the break period by at least five minutes, at the end of which blood pressure rates will be re-measured and the end-of-break criteria again applied.

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

4.9 Training

4.9.1 Employees and their Supervisors that may be exposed to the hazard will be trained and oriented to the hazard and the controls prior to work commencing.

4.9.2 Those Employees, including Supervisors, potentially exposed to heat stress will receive training, refer to the *S3AM-003-PR1 SH&E Training* procedure. Training will include, but is not limited to:

- Sources of heat stress (environmental and personal), influence of protective clothing, and importance of acclimatization;
- How the body handles heat and acclimatization;
- Recognition of heat-related illness symptoms;
- Preventative/corrective measures including, but not limited to;
  - Employees will be informed of the harmful effects of excessive alcohol consumption in the prevention of heat stress.
  - All Employees will be informed of the importance of adequate rest and proper diet in the prevention of heat stress.
- First aid procedures for heat stress-related illnesses; and
- Immediate reporting of any heat-related incident (injury, illness, near-miss), refer to the *S3AM-004-PR1 Incident Reporting, Notifications & Investigation* procedure.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-113-ATT1 Heat Stress - Temperature Thresholds

6.2 S3AM-113-ATT2 Heat Stress - Symptoms & Treatment

6.3 S3AM-113-ATT3 Dehydration Chart

6.4 S3AM-113-FM1 Heat Stress Monitoring Log

6.5 S3AM-113-FM2 Daily Heat Illness Prevention Log

6.6 S3[DCS]AM-113-FM1 Heat Illness Prevention Plan – DCS Americas

Americas

Spill Notification Numbers for North America

S3AM-117-ATT1

Jurisdiction	Name	Phone
Within the United States		
National Response Center		1-800-424-8802
AECOM Incident Reporting Number		1-800-348-5046
Within Canada		
AECOM Incident Reporting Number		1-800-348-5046
Alberta	Environmental Service Response Centre	1-800-222-6514
British Columbia	Provincial Emergency Program	1-800-663-3456
Manitoba	Conservation Emergency Response Program	1-204-944-4888
New Brunswick	Canadian Coast Guard	1-800-565-1633
Newfoundland & Labrador	Canadian Coast Guard	1-800-563-9089
NWT & Nunavut	Spill Report Line	1-867-920-8130
Nova Scotia	Canadian Coast Guard	1-800-565-1633
Ontario	Spill Action Centre	1-800-268-6060
Prince Edward Island	Canadian Coast Guard	1-800-565-1633
Quebec	National Environmental Emergencies Center	1-866-283-2333
Saskatchewan	Spill Report Centre	1-800-667-7525
Yukon Territory	Spill Report Centre	1-867-667-7244

Americas

Hazardous Waste Operations

S3AM-117-PR1

1.0 Purpose and Scope

1.1 Provides requirements for AECOM operations pertaining to hazardous waste and emergency response (HAZWOPER) services. In Canada and South America, there is no direct counterpart to HAZWOPER; however, as due diligence and in compliance with applicable duty of care/general duty clauses, staff working in Canada and South America will comply with this procedure as far as it aligns with the location's respective legislation.

1.2 Provides a procedure intended to address small incidental spills from work related equipment and supplies. For operations with bulk quantities of fuels, chemicals, oils, and for operations where AECOM is providing emergency response services for spills, the SH&E Manager or designee shall specify spill prevention and preparedness criteria including training, equipment, and proficiency.

1.3 To define appropriate procedures to decontaminate both equipment and personnel when exposure to hazardous chemicals or physical agents has occurred.

1.4 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 **Contamination Reduction Zone (CRZ)** – The transition area between the contaminated area and the clean area where decontamination activities occur.

2.2 **Decontamination** – The process of removing or neutralizing contaminants that have accumulated on personnel or equipment.

2.3 **Emergency Response** – A response effort by employees from outside the immediate release area or by other designated responders (e.g.., mutual-aid groups, local fire departments, etc.) to an occurrence that results, or is likely to result, in an uncontrollable release of a hazardous substance or whenever a release requires that a federal, state, territorial or provincial agency be notified, such as:

- A release at or above a reportable quantity (RQ) of a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substance (40 CFR 302.8) is required to be reported to the National Response Center (NRC).
- A release at or above provincial reporting thresholds, if any, or alternatively those specified under the Canadian Transportation of Dangerous Goods Act are reportable under the Canadian Environmental Protection to the respective provincial or territorial Environmental Regulatory Agency .
- A hazardous chemical release at or above an RQ under the Emergency Planning and Community Right-to-Know Act (EPCRA) (Title III under the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 350-372) is required to be reported to state and local officials.
- A release in violation of a facilities Spill Prevention, Control, and Countermeasure (SPCC) Plan (40 CFR 112).

Responses to incidental release of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area or by maintenance personnel are not considered to be emergency responses within the scope of the HAZWOPER standard. Responses to releases of hazardous substances where there is no potential safety or health hazard are not considered to be emergency responses.

2.4 **Exclusion Zone (EZ)** – The area where contamination does or could occur.

2.5 **First Responder** – First responders are individuals who are likely to witness or discover a hazardous substance release, injury, fire, or other incident and who have been trained to initiate an emergency response sequence by notifying the proper authorities of the release. They would take no further action beyond first aid, initial control of the incident, and notifying the authorities and others of the incident.

2.6 **Hazardous Materials** – A hazardous material is any item or agent (biological, chemical, physical) that has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors. Additionally a hazardous material may be defined as any substance or chemical which is a "health hazard" or "physical hazard," including chemicals that are carcinogens, toxic agents, irritants, corrosives, sensitizers; agents that act on the hematopoietic system; agents that damage the lungs, skin, eyes, or mucous membranes; chemicals that are combustible, explosive, flammable, oxidizers, pyrophoric, unstable-reactive, or water-reactive; and chemicals that in the course of normal handling, use, or storage may produce or release dusts, gases, fumes, vapor, mists, or smoke that may have any of the previously mentioned characteristics. This may be caused when released by spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, disposing into the environment, by being transported or moved, and items or chemicals that are "special nuclear source" or by-product materials or radioactive substances.

2.7 **Hazardous Materials Specialist** – Hazardous materials specialists are individuals who respond with and provide support to hazardous materials technicians. Their duties parallel those of the hazardous materials technician; however, those duties require a more directed or specific knowledge of the various substances they may be called upon to contain. The hazardous materials specialist would also act as the site liaison with federal, state, local, and other government authorities in regards to site activities.

2.8 **Hazardous Materials Technician** – Hazardous materials technicians are individuals who respond to releases or potential releases for the purpose of stopping the release. They assume a more aggressive role than a first responder in that they will approach the point of release in order to plug, patch, or otherwise stop the release of a hazardous substance.

2.9 **Hazardous Waste** – Hazardous waste is waste that is dangerous or potentially harmful to our health or the environment. Hazardous wastes can be liquids, solids, gases, or sludge. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes. Hazardous waste are divided into:

- Listed wastes (http://www.epa.gov/osw/hazard/wastetypes/listed.htm);
- Characteristic wastes (http://www.epa.gov/osw/hazard/wastetypes/characteristic.htm);
- Universal wastes (http://www.epa.gov/osw/hazard/wastetypes/universal/index.htmwastes); and
- Mixed wastes;
- Specific procedures determine how waste is identified (http://www.epa.gov/osw/hazard/wastetypes/wasteid/index.htm), classified, listed, and delisted.

2.10 **Health and Safety Plan (SH&E PLAN)** – A document prepared for each project that contains site-specific information including the Emergency Response Plan for the project.

2.11 **Incidental Releases** - A response to a spill or release of a hazardous substance (in quantities below its RQ) where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area using equipment and materials available to them at the time or the spill or release. Any spill or release that cannot be managed with the personnel, materials, and equipment at the site shall be considered an Emergency Response.

- Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses. Handling of incidental releases shall be in accordance with applicable standard operating procedures.

2.12 **Incident Command System (ICS)** – ICS is a standardized on-scene incident management concept designed specifically to allow responders to adopt an integrated organizational structure equal to the complexity and demands of any single incident or multiple incidents without being hindered by jurisdictional boundaries. In the ICS the first person responding to an incident becomes the Incident Commander and turns that title and duties over to more qualified responders as they arrive on scene.

2.13 **Incident Commander** – The Incident Commander (IC) is responsible for all aspects of the response, including developing incident objectives and managing all incident operations. The title and responsibilities are typically assumed by a qualified IC from the client or public sector.

2.14 **Support Zone (SZ)** – An uncontaminated zone where administrative and other support functions (e.g. first aid, equipment supply, emergency information, etc.) are located.

3.0 References

3.1 SR1-003-WI2 Disruptive Event Response Instruction

3.2 S3AM-003-PR1 SH&E Training

3.3 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.4 S3AM-010-PR1 Emergency Response Planning

3.5 S3AM-012-PR1 First Aid

3.6 S3AM-017-PR1 Injury & Illness Recordkeeping

3.7 S3AM-127-PR1 Exposure Monitoring

3.8 S3AM-128-PR1 Medical Screening & Surveillance

3.9 S3AM-208-PR1 Personal Protective Equipment

3.10 S3AM-209-PR1 Risk Assessment & Management

3.11 S3AM-213-PR1 Subcontractor Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

- Enforces and supports the implementation of SH&E Plans, Location Specific Emergency Response Plans, and Spill Response Plans;
- Prepare or request a SH&E Plan for every AECOM project with Hazardous Waste Operations and Emergency Response Activities, refer to *S3AM-209-PR1 Risk Assessment & Management*;
- Verify that all personnel working on the project are qualified to perform the activities they are assigned (see HAZWOPER and Emergency Spill Response Training requirements below);
- Request client's emergency response procedures;
- Appoint a Site Safety Officer (SSO) with appropriate qualifications for the specific hazardous waste project;
- Confirm that the SSO for complex projects, such as those with complicated remediation activities, has no duties other than site safety and health of the field team;
- Confirm the communication of the location-specific emergency response plan details to all employees assigned to a field project;
- Authorize the procurement of the necessary decontamination supplies;

- Verify that the applicable decontamination steps are clearly defined in the approved SH&E Plan;
- Verify staff are appropriately trained to execute the defined decontamination procedures;
- Verify that adequate staffing is available to safely conduct the applicable decontamination steps;
- Confirm that the necessary communications equipment for the project is available;
- Confirm that incident investigations are performed as required and a report is filed. Refer to *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*;
- During spill response, all AECOM emergency responders and their communications shall be coordinated and controlled through the Manager. The individual in charge shall implement the and shall be responsible for the following tasks:
    - Become the individual in charge at the incident until relieved by more qualified personnel;
    - Notify the appropriate agency, the AECOM incident Reporting line, and operations. Refer to *S3AM-117-ATT1 Spill Notification Numbers North America* for US and Canadian required notifications;
    - Designate a safety supervisor who is knowledgeable about the operations being implemented at the emergency response site and who will have specific responsibility to identify and evaluate hazards and to provide direction on the safety of operations for the emergency at hand. If the safety supervisor judges activities to be an Immediately Dangerous to Life or Health (IDLH) and/or to involve an imminent danger condition, the safety supervisor shall have the authority to alter, suspend, or terminate those activities. The safety official shall immediately inform the individual in charge of the ICS of any actions needed to be taken to correct these hazards at the emergency scene;
    - Identify all hazardous substances or conditions present and address as appropriate site analysis, use of engineering controls, maximum exposure limits, hazardous substance, and handling procedures;
    - Implement appropriate emergency operations. Refer to *S3AM-010-Emergency Response Planning*;
    - Limit the number of emergency response personnel at the emergency site;
    - Implement the buddy system in groups of two or more;
    - Confirm that the PPE worn is appropriate for the hazards to be encountered;
    - Implement appropriate decontamination procedures after emergency operations have terminated.
- Responsibility for the emergency response shall be transferred upon arrival of a more qualified AECOM Incident Commander or a Public Service Incident Commander.
- Confirm appropriate communications concerning an emergency event are initiated as per *S3AM-010-PR1 Emergency Response Planning* and *SR1-003-WI2 Disruptive Event Response Instruction*.

4.1.2 **SH&E Manager or designee**

- Provide technical guidance for:
    - The development and implementation of SH&E Plans and Emergency Response Plans;
    - The Incident Commander regarding the correct way to respond to the spill;
    - Project-specific Spill Response Plans when required;

- Prepare emergency action plans as part of project SH&E Plans and emergency reference sheets;
- Interface with the local emergency responders when necessary;
- Interface with clients regarding facility emergency response procedures;
- Decide whether AECOM or an outside emergency response company will clean up the spill;
- Report spills, as necessary, to state/provincial environmental agencies;
- Review the incident report and facilitate the post-response discussion;
- Review and revise this procedure as necessary based on recommendations from post-response discussions;
- Advise Managers and Supervisors on the necessary decontamination procedures for the known or reasonably anticipated chemical hazards and physical agents associated with the planned scope of work;
- Support the project team to verify that adequate protective measures are in-place (e.g. Engineering Controls, Administrative Controls, Personal Protective Equipment, etc.).

4.1.3 **Site Safety Officer (SSO)**

- Verify that a SH&E PLAN is available for the project and is reviewed prior to the commencement of site activities;
- Conduct pre-entry briefing and daily tailgate meetings and review facility, site-specific emergency procedures, and site specific decontamination procedures;
- Communicate the site-specific emergency response details to all employees assigned to a field project;
- Establish the designated site work zones (e.g., EZ, CRZ, SZ, etc.);
- Enforce the applicable decontamination steps as defined in the approved SH&E Plan;
- Initiate Stop Work and emergency response procedures as required;
- Account for all AECOM and subcontractor employees after site evacuation;
- Brief on-site and off-site responders in the event of an emergency;
- Conduct site-specific training on the applicable decontamination steps/procedures;
- Procure the necessary decontamination supplies and establishing the decontamination line;

4.1.4 **Employees**

- Maintain HAZWOPER training, or equivalent training as it relates to the given jurisdiction;
- Follow the SH&E Plan and emergency procedures prepared for the project;
- Initiate Stop Work if necessary;
- Initiate emergency response via verbal communications or the alarm system if first to encounter an emergency;
- Follow the defined decontamination steps as stated in the approved SH&E Plan;
- Follow precautions and safe handling practices to avoid spills;
- Alert Manager to any deteriorating hazardous materials containers within the office or project area;
- Report all spills and leaks to the Manager immediately;
- Secure the spill area as quickly as possible and prevent the migration of exterior spilled materials or substances to drains or other openings; and

4.1.5 **All personnel** (e.g., AECOM employees, general laborers, equipment operators, chemists, supervisors, etc.) performing activities at hazardous waste sites that expose or potentially expose them to hazardous wastes and health hazards are considered HAZWOPER site workers and shall meet the training and medical surveillance requirements specified in 29 CFR 1910.120(e) and (f), respectively. Additional training may be required based on site activities including related exposures and risks (e.g., confined space entry, excavations, fall protection, other materials [lead], etc.). These additional training requirements are to be outlined in the project- or site-specific SH&E Plan.

4.2 Project SH&E Documentation—SH&E Plan

4.2.1 The project SH&E documentation prepared for HAZWOPER activities is referred to as a site-specific SH&E Plan, and shall meet the requirements presented in 29 CFR 1910.120(b)(4).

4.2.2 A safety and health risk or hazard analysis for each on-site task that will be performed.

4.2.3 The required SH&E Plan elements include:

- A description of the work location, the site history, and a summary of any information available concerning site hazards (including both physical hazards and contamination conditions);
- A summary of the work activities to be performed under AECOM's scope of activities;
- Identified risks shall include both chemical and physical hazards to which personnel may be exposed during the conduct of the work task;
- Protective measures for each work task to prevent or mitigate the potential hazards identified in the hazard analyses;
- Personal protective equipment (PPE) requirements for each work task**.** Refer to *S3AM-208-PR1 Personal Protective Equipment*;
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used;
- Site control measures;
- Decontamination procedures;
- An emergency response plan, *S3AM-010-PR1 Emergency Response Planning*, addressing actions to be taken in the event of each type of credible incident that might result during the performance of planned work activities, including minor and major injuries, and chemical release and fire. Response plans shall address the means for coordinating the evacuation of all on-site personnel in the event of a catastrophic incident.

4.2.4 Responsibility for development of each AECOM SH&E Plan will be coordinated between the Manager and the SH&E Manager or SH&E Department designee as part of project initiation. Regardless of where the SH&E Plan is developed, it will be reviewed and approved by the SH&E Manager prior to submission to any agency outside of AECOM.

4.2.5 Contractors and Subcontractors

- The health and safety of the employees of any contractor or subcontractor who does not have a contract directly with AECOM, and for whom AECOM does not have contractual safety oversight, is the responsibility of that contractor or subcontractor. The contractor or subcontractor shall evaluate the hazards and potential hazards to their own employees and shall adhere to their own Health and Safety Plan;
- Subcontractors who maintain a contract directly with AECOM shall comply with AECOM SH&E program requirements. Refer to *S3AM-213-PR1 Subcontractor Management*;
- In addition, all AECOM subcontractors' Health and Safety Plans shall, at a minimum conform to the requirements of the AECOM SH&E Plan. The AECOM SH&E Plan does not, nor is it intended to, address procedures of contractors or subcontractors during their site activities.

4.3 Personnel Qualifications— Training and Medical Surveillance

4.3.1 HAZWOPER-qualified employees shall participate in the following medical surveillance and training requirements. Medical surveillance and SH&E training requirements are further described in *S3AM-128-PR1 Medical Screening & Surveillance* and *S3AM-003-PR1 SH&E Training* respectively.

4.3.2 Employees receiving initial and refresher responder training shall be issued a certificate indicating training competency. Copies of all training records shall be maintained in accordance with the *S3AM-003-PR1 SH&E Training*.

4.3.3 Medical Surveillance

- Specific HAZWOPER medical examination protocols have been developed by AECOM's Corporate Medical Provider (CMP) to meet the requirements of 29 CFR 1910.120(f). To be medically qualified to perform HAZWOPER work, employees receive the following medical examinations:
    - Initial (Baseline) Examination — The initial examination is part of pre-employment requirements and shall be completed (with results received) prior to the employee's start of work date;
    - Annual Examination — HAZWOPER-qualified employees will complete a medical examination once each year. Medical qualification expires on the anniversary date of the last examination completed. There will be no "grace period" exemptions beyond this date without the express approval of the Region SH&E Manager. At the recommendation of the SH&E Department, the CMP may approve an alternate examination frequency at periods of up to two years (biennial) in cases in which the worker's exposures to environmental contaminants are infrequent and typically well below any occupational exposure limits (e.g., senior management personnel);
    - Termination Examination — When reassigned to non-HAZWOPER duties or at the conclusion of employment at AECOM, HAZWOPER-qualified personnel will be provided with the opportunity to receive a termination medical examination;
    - Special Examinations — The SH&E Department and the CMP will jointly determine the need for special examinations because of:
        - Unusual exposure conditions; and
        - In response to possible overexposures.
- The CMP will determine the medical protocol elements for each of these examinations based on exposure information provided by the SH&E Department. The CMP will evaluate the results of each Employee's examination and will provide a written statement of medical clearance clearly stating medical compliance with the HAZWOPER regulatory standard (29 CFR 1910.120(f)) and approval of the Employee to perform unrestricted HAZWOPER activities. For initial and annual examinations, the CMP will also evaluate the Employee for the use of air purifying and supplied air respiratory protection. The written evaluation from these examinations will indicate the CMP's approval/limitations on the Employee's use of respiratory protection;
- If an Employee does not wish to participate in part or in the complete medical surveillance program, and is permitted by the given jurisdiction, the employee shall provide a written statement of refusal. Refer to *S3AM-128-PR1 Medical Screening & Surveillance*;

4.3.4 Training - HAZWOPER

All personnel assigned to work at a hazardous waste site, sampling at Treatment, Storage and/or Disposal Facilities (TSDFs), or are performing Remediation and Investigation Activities, shall participate in training meeting the requirements of 29 CFR 1910.120(e), or equivalent training as it relates to the given jurisdiction. All personnel shall have the following training:

- 40-hour initial Training — Before being assigned to a HAZWOPER site, AECOM Employees shall complete 40 hours of off-site training meeting the requirements of 29 CFR 1910.120(e)(3)(i). At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (40-hour HAZWOPER) and training dates. A copy of this certification shall be provided to the employee's SH&E Manager. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the SSO when working on any HAZWOPER site;
- 3 days of on-the-job training — The Employee shall receive 3 days of actual supervision by a trained experienced supervisor;
- Refresher 8-Hour Training — To remain qualified to perform on-site HAZWOPER work activities, each AECOM Employee will complete 8 hours of HAZWOPER refresher training meeting the requirements of 29 CFR 1910.120(e)(8) at yearly intervals following completion of Initial 40-hour training. At the conclusion of training, personnel will receive a written certification of course completion, signed by the instructor, that indicates the course of instruction (8-hour HAZWOPER Refresher) and the training date. A copy of this certification shall be provided to the employee's SH&E Manager. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the SSO when working on any HAZWOPER site;
- 8-hour Supervisor 8-Hour Training - any AECOM Employee acting in a management capacity for HAZWOPER activities (e.g., project manager, site safety officers, etc.), including oversight of subcontractor HAZWOPER activities, shall complete an additional 8 hours of HAZWOPER Supervisor training meeting the requirements of 29 CFR 1910.120(e)(4). Although this training is required only once, supervisors shall maintain their overall HAZWOPER qualification through annual completion of refresher training. At the conclusion of Supervisor 8-Hour Training personnel will receive a written certification of course completion, signed by the instructor that indicates the course of instruction and the training date. A copy of this certification shall be provided to the SH&E Manager. Employees are responsible for maintaining their own copy of this certificate and for presenting it to the SSO when working on any HAZWOPER site;
- 24-Hour HAZWOPER Training — Site support contractors and site visitors may qualify to substitute 24-hour HAZWOPER training in place of 40-hour training, as specified in 29 CFR 1910.120(e)(3)(ii). Personnel potentially qualifying for this alternative training include:
    - Site support personnel who will not work in any Exclusion Zone areas;
    - Subcontractors and site visitors whose duties will not entail significant exposure to site contaminants defined as not working in any areas where airborne contaminant concentrations exceed one-half of any applicable occupational exposure limit, and no contact or exposure to materials with site contaminant concentrations exceeding natural background levels. The SH&E Manager shall approve the substitution of 24-hour training for initial 40-hour training. Persons qualifying for 24-hour training shall provide written certification of course completion prior to beginning work on site. Persons completing 24-hour training shall complete 8 hours of annual refresher training at the required interval to maintain eligibility for on-site work and shall provide proof of this training (as necessary to demonstrate retraining) prior to beginning work on site.

Available Training Sources:

- On-site training provided by the SH&E Department;
- Outsourced training providers approved by the SH&E Department;

4.3.5 Training – Emergency Response

On an as-needed basis, if a project requires AECOM to provide a HAZMAT emergency response team, the following training requirements shall be met:

- Operations Level – a minimum of 8 hours of initial and refresher training for those responsible for acting defensively in the case of a release, attempting to contain the release from a safe distance;
- HAZMAT Technician – at least 24 hours of initial training and 8 hours of refresher training. They will participate in operations-level training and know how to implement the emergency response plan for the facility/site/project location;
- HAZMAT Specialist – at least 24 hours of initial training and 8 hours of refresher training. They will be trained in the same content as the HAZMAT Technician, as well as in how to develop a site safety and control plan;
- Incident Commander – will have at least 40 hours of training covering the Operations Level training and techniques for implementing the emergency response plan and directing the incident. They will be knowledgeable in relevant regulations. The Incident Commander will become the individual in charge of a site-specific incident command system and will coordinate and control communications with external agencies;

4.3.6 Subcontractor Personnel Training Records

Any subcontractor organization whose employees will support AECOM operations at a HAZWOPER site will:

- Provide the Manager with a copy of their written HAZWOPER medical surveillance and training program requirements. The elements of the program(s) shall be similar to those for AECOM's own program, as detailed above. Refer to *S3AM-213-PR1 Subcontractor Management*;
- Provide the Manager with written certification of a physician's approved medical clearance for each employee who will work on the site. Certification can be demonstrated by:
    - A copy of the physician's signed medical clearance for each employee (preferred); or
    - A letter identifying the medical status and clearance expiration date of every employee, signed by the company's safety director or an officer of the company.
    - A copy of the each employee's training certifications, which will include:
        - The initial 40-hour training certificate (24-hour training may be substituted with SH&E Manager approval);
        - The most current Refresher training certificate (shall be current within the previous one-year period);
        - A copy of the Supervisor training certificate for each person serving in a site supervisory capacity (e.g., project manager, site safety officers, etc.).

4.4 HAZWOPER and Spill Response Equipment

4.4.1 Specific HAZWOPER activity and spill response equipment shall be identified in the site specific SH&E PLAN. All AECOM offices and project sites that store chemicals at their location shall have the appropriate spill response equipment. Such equipment may include the following:

- Over-pack containers of varying capacities;
- Absorbent material such as vermiculite or commercially prepared, absorbent containing pillows, rolls, sheets, or booms;
- Acid and base neutralizing agents;
- Chemically resistant gloves for solvents, alcohols, and acids;
- Poly-coated Tyvek coveralls;
- Safety goggles;
- Respiratory protection;

4.4.2 Spill response equipment shall be placed adjacent to areas where chemicals are routinely handled, stored, and/or where shipments are received. Similar types of spill response equipment shall also be available in any AECOM vehicle or rented vehicle in which chemicals are being transported. Location of spill response equipment shall be selected to permit access outside of likely spill locations.

4.4.3 Spill Response Equipment for Field Programs

- The amount of chemicals being used during a field program will dictate the types and quantity of spill response equipment that is brought to the site;
- If several squirt bottles of decontamination solution are all that is being brought to a site, a few spill pillows and a one-gallon bucket (3.8 liters) may be sufficient to respond to a spill of these materials;
- If gallons of chemicals are being delivered to the site in drums or bulk tanks, a greater variety of spill response equipment will be needed. As indicated previously, during these types of field programs, a separate spill plan will be incorporated into the project or site specific SH&E Plan, and will provide a greater level of detail regarding the specific spill response effort for that field program. Refer to *S3AM-209-PR1 Risk Assessment & Management*;

4.5 Personal Protective Equipment (PPE) Ensembles

4.5.1 Defined HAZWOPER PPE ensembles are specified for general use on all AECOM HAZWOPER operations. The project SH&E Plan may specify modifications to these requirements to meet site-specific conditions. Refer also to *S3AM-208-PR1 Personal Protective Equipment* for additional information concerning PPE requirements.

4.5.2 Level D Ensemble

The Level D ensemble provides a minimal level of skin protection (primarily against physical rather than chemical hazards) and no respiratory protection. Level D PPE is the minimum work uniform to be used on HAZWOPER sites. Its use is appropriate when there is no significant potential for encountering hazardous substances or health hazards while working in controlled work areas.

Level D Equipment List:

- Hard hat;
- Eye protection;
- Safety-toe work boots;
- Shirts with sleeves and long pants (shorts are unacceptable for use); and
- Hearing protection (as required).

4.5.3 Modified Level D Ensemble

The Modified Level D ensemble provides moderate skin protection against contact with hazardous substances, but no respiratory protection. Its use is appropriate where there is a moderate-to-low potential for skin contact with known hazardous substances and health hazards, but no significant inhalation hazard is anticipated. The Modified Level D ensemble will consist of the Level D ensemble, supplemented by the addition of one or more of the following items:

Modified Level D Equipment List:

- Full faceshield;
- Plain (uncoated) disposable coveralls;
- Chemical-resistant disposable outer coveralls;

- Chemical-resistant outer gloves taped to outer coveralls;[1]
- Chemical-resistant inner gloves; and[1]
- Chemical-resistant safety-toe boots (taped to outer coveralls).

4.5.4 Level C Ensemble

The Level C ensemble provides moderate skin protection against contact with hazardous substances and moderate respiratory protection. Its use is appropriate where there is the potential for skin contact with known hazardous substances and health hazards, together with a limited and well-defined potential for exposure via inhalation.

Level C Equipment List:

- Full-face air-purifying respirator (APR) equipped with cartridge types as designated in the project SH&E PLAN;[2]
- Plaind (uncoated) disposable coveralls;
- Chemical-resistant disposable outer coveralls;
- Chemical-resistant outer gloves taped to outer coveralls;[3]
- Chemical-resistant inner gloves;
- Hard hat;
- Safety-toe boots taped to coveralls; the use of boot covers (e.g., booties) or chemical-resistant boots may be specified; and
- Hearing protection (as required).

4.5.5 Level B Ensemble

The Level B ensemble provides both the highest level of inhalation exposure protection and considerable skin contact protection. Its use is appropriate where there are significant known or suspected hazardous substances and health hazards, involving both skin and inhalation exposure (up to and including Immediately Dangerous to Life or Health [IDLH] conditions) or where adverse atmospheric conditions cannot be mitigated by use of air purifying respirators (e.g. oxygen deficient atmospheres or chemicals with poor warning properties). The use of Level B PPE requires prior approval by the SH&E Manager.

Level B Equipment List:

- Supplied air respirator (SCBA or airline system with Grade D or better breathing air);
- Chemical-resistant disposable outer coveralls;
- Chemical-resistant outer glove taped to outer coveralls;[3]
- Chemical-resistant inner gloves;[3]
- Hard hat;
- Chemical resistant safety-toe boots taped to coveralls; and
- Hearing protection (as required).

1 Selection of specific glove types/materials will be provided in the project SH&E Plan based on consideration of the contaminants and the physical conditions of the work.

2 Selection of specific cartridges will be made by the SH&E Department (or Competent Person – Respiratory Protection as designated by the SH&E manager) based on contaminants present. A cartridge change-out frequency will also be specified in the SH&E based on the manufacturer's cartridge performance data.

3 Selection of specific glove types/materials will be provided in the project SH&E based on consideration of the contaminants and the physical conditions of the work.

4.5.6 Level A Ensemble

The Level A ensemble provides the highest level of both respiratory and skin protection, up to and including protection against skin contact with vapor-phase contaminants. The use of Level A PPE requires prior approval by the Americas SH&E Director.

Specific Level A ensemble components will be determined on a case-by-case basis by the SH&E Department.

4.6 Emergency Response Plans

4.6.1 A Location Specific Emergency Response Plan shall be developed and implemented to handle anticipated emergencies prior to performing emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives, and OSHA personnel. The plan shall be reviewed and approved by the SH&E Manager prior to issue.

4.6.2 AECOM'S *S3AM-010-PR1 Emergency Response Planning* shall apply and employees shall evacuate from the danger area whenever an emergency occurs, provided the associated contract does not require AECOM to provide emergency response services

4.6.3 AECOM Employees are not expected to take action or to participate in rescues or responses to chemical releases beyond the initial discovery of the release and immediate mitigation actions such as closing a valve, placing absorbents, and notifying the client and or public emergency response system (911).

- If AECOM Employees are to participate in the response to a chemical release beyond the initial reaction, there shall be a contractual provision for this response and the Employees shall be specifically trained for this response;
- This document is designed to provide guidelines on how to prepare a written plan that will confirm prompt and proper response to an emergency situation that arises during field investigations and to outline the duties of AECOM Employees during a field emergency and the associated training requirements.

4.6.4 Site specific SH&E plans that are prepared to comply with the HAZWOPER standard (29 CFR 1910.120) shall address emergency response. This standard specifically outlines the elements that shall be contained in an emergency response plan. However, the definition of emergency response, as written in 29 CFR 1910.120, focuses on emergencies involving the uncontrolled release of hazardous substances. Under 29 CFR 1910.120, an employer can opt to evacuate employees from the danger area when such an emergency occurs. AECOM does not expect its Employees to actively assist in the handling of uncontrollable chemical releases that may occur during the implementation of field programs. As such, and as provided by the HAZWOPER standard, AECOM is exempt from the emergency response plan requirements of the standard as long as it provides an emergency action plan within the SH&E PLAN that complies with 29 CFR 1910.38 (a). Therefore, all emergency response plans required under 29 CFR 1910.120 will be written to comply with 29 CFR 1910.38 (a).

- There are two types of emergency situations that AECOM personnel shall be prepared for and that shall be addressed in the emergency response plan. These include:
  - Emergencies related to the operations of our clients at the facility where AECOM is working;
  - Emergencies related to our own on-site activities/investigations.
- Employees are not to accept the role of Incident Commander without specific authority from the SH&E Manager and the Manager responsible for the project. Assuming the role of the Incident Commander requires training beyond the scope of this Procedure.

4.6.5 The HAZWOPER standard does not prohibit AECOM Employees from performing limited response activities.

- Appropriately trained AECOM Employees can provide voluntary First Aid services;
- AECOM Employees can provide response assistance by placing absorbent pillows or vermiculite around a small, contained spill that occurs during sampling efforts;
- Refer to Spill Response, Incidental procedures contained herein which describes the specific procedures that AECOM will follow when responding to an incidental chemical spill.

4.6.6 Field Project Preparation

- Every SH&E Plan that is prepared by AECOM will contain a Location Specific Emergency Response Plan in which the required elements of an emergency action plan will be addressed. Refer to *S3AM-010-PR1 Emergency Response Planning*;
- When AECOM is working at an operating facility, the emergency response procedures of the facility will be appended to the SH&E Plan or the Location Specific Emergency Response Plan;
- As a minimum, each emergency response plan shall contain the following topics as required by 29 CFR 1910.38 (a):
    - Procedures and contact information for reporting emergencies to public service responders and on-site (client or host employer) emergency control centers;
    - Pre-emergency planning and coordination with outside parties;
    - Emergency escape procedures and emergency escape route assignments;
    - Procedures to be followed by employees who remain to operate critical site operations before they evacuate;
    - Procedures to account for all employees after emergency evacuation is complete;
    - Rescue and medical duties for those employees who are trained to perform them;
    - Preferred means of reporting fires and other emergencies;
    - PPE to protect employees from expected exposures and potential exposures during an emergency;
    - Names of persons or departments who can be contacted for further information (i.e. emergency reference sheet);
    - Site security and control;
    - Availability of medical surveillance for workers who might have been exposed to chemicals, bloodborne pathogens, or other biological agents as a result of project work or emergency response;
    - Emergency medical treatment and first aid;
    - Emergency alerting and response procedures;
    - Critique of response and follow-up.
- In addition, each plan shall establish the specific alarm system that will be used on site to warn employees of an AECOM emergency. The chosen alarm signals should not conflict with alarm signals already in place at the facility.

4.6.7 Client Facility Emergency Response Procedures

- AECOM implements field programs on active properties, including manufacturing facilities. These facilities have typically developed an emergency response plan that is specific to facility-related emergencies. If AECOM is working at an operating facility, emergency procedures established by the facility shall be followed in the event of a facility catastrophe.

AECOM personnel shall be aware of and familiar with the alarm signals used at the facility to alert personnel to an emergency. AECOM personnel shall also know where to assemble in the event of a facility evacuation as the facility shall be able to account for all personnel, including subcontractors such as AECOM in the event of an evacuation.

- The first priority in AECOM's preparation of a project emergency action plan is to confirm that the responsibilities under the client's emergency response plan are fully understood. Because of the nature of their business, many of our clients have in-house fire brigades, medical staff, and hazardous materials teams that can assist AECOM in the event of an emergency related to our field activities. In many instances, our clients prefer or require that subcontractors seek emergency assistance through their facility first before calling outside responders to the site.
- A copy of the facility's procedures shall be made available to AECOM so that the information can be incorporated into the SH&E Plan or attached to the Location Specific Emergency Response Plan. If this information is not available to AECOM prior to arriving on site, the SSO shall meet with client representatives upon arrival to the facility to review procedures in the event of an emergency related to plant operations.

4.6.8 Escape Routes and Procedures

Although emergency evacuation procedures are included in AECOM's initial 40-hour HAZWOPER training, emergency procedures at each site will be different. Employees shall be instructed about the location specific emergency response plan. Updating training is required anytime escape routes or procedures change. An evacuation drill will be conducted for projects that are scheduled for one month or longer. Visitors and untrained employees shall not be allowed into the project area until they receive a safety briefing including evacuation alarms and procedures.

Prior to the commencement of on-site activities, the SSO shall determine how AECOM employees will evacuate each AECOM work area of the site:

- Two or more routes that are separate or remote from each other for each work area shall be identified. Multiple routes are necessary in case one is blocked by fire or chemical spill. These routes shall not overlap because, if a common point were obstructed, all intersecting routes would be blocked;
- Prominent wind direction should also be considered when designating escape routes and assembly areas. Escape routes and assembly areas should be upwind of the site whenever possible;
- Upon arrival to the site, the SSO shall verify that the selected routes are appropriate for evacuation. During an emergency, the quickest and most direct route should be selected. However, when working at an operating facility, the established escape routes of the facility should be used whenever possible;
- In the event of a facility-related emergency, all AECOM employees shall meet at the facility's assembly area so that the client can verify that AECOM has evacuated the property.

4.6.9 Alarm Signals

An emergency communication system shall be in effect at all sites.

- The most simple and effective emergency communication system in many situations will be direct verbal communications. However, verbal communications shall be supplemented any time voices cannot be clearly perceived above ambient noise levels and any time a clear line of sight cannot be easily maintained among all AECOM personnel because of distance, terrain, or other obstructions;
- Portable two-way radio communications may be used when employees shall work out of the line of sight of other workers;
- When it is necessary to supplement verbal communications, Employees shall be informed of the established emergency signals. The following emergency signals, or other appropriate signals, shall be implemented using handheld portable air horns, whistles, or similar devices.

Signals shall be capable of being perceived above ambient noise by all employees in the affected portions of the workplace:

- One Blast: General Warning—A relatively minor and localized, yet important, on-site event. An example of this type of an event would be a minor chemical spill where there is no immediate danger to life or health yet personnel working on the site should be aware of the situation so that unnecessary problems can be avoided. If one horn blast is sounded, personnel shall stop all activity and equipment on-site and await further instructions from the SSO;
- Three Blasts: Medical Emergency—A medical emergency for which immediate first aid or emergency medical care is required. If three horn blasts are sounded, all First Aid Providers should respond as appropriate. All other activity and equipment should stop and personnel should await further instructions from the SSO;
- Three Blasts Followed by One Continuous Blast: Immediate Threat to Life and Health — A situation that could present an immediate danger to life and health of personnel onsite. Examples include fires, explosions, large hazardous chemical release, severe weather-related emergencies, or security threats. If three horn blasts followed by a continuous blast are sounded, all activity and equipment shall stop. All personnel shall evacuate the site and meet in the designated assembly area where the SSO will account for all employees. The SSO will arrange for other emergency response actions if necessary. Information concerning the need to follow decontamination procedures during an emergency evacuation will be addressed in the Location Specific Emergency Response Plan;

- The SSO or his designate will acknowledge the distress signal with two short blasts on the air-horn or whistle;
- One Continuous Blast Following Any of the Above: All Clear/Return to Work — Personnel who sound the initial alarm are required to send an all clear signal when the emergency is over.

4.6.10 Accounting Method for All Employees after Evacuation

The SSO is responsible for determining that all AECOM employees have been successfully evacuated from the work area(s):

- It is the responsibility of each AECOM subcontractor to verify that all of its employees evacuated the site and to report this information to the SSO. All employees shall meet at the designated assembly area;
- A headcount is an acceptable way to determine complete evacuation when the field team is of a small size. The site log-in book or equivalent should be referenced when attempting to account for more than 10 people. In the event of a facility-related emergency, the SSO shall notify facility representatives that all AECOM employees and AECOM subcontract employees have successfully evacuated the work area(s);
- The SSO shall notify emergency responders if any employee is unaccounted for and where on the site they were last seen;
- In the event of a project-related emergency, the SSO will provide off-site emergency responders or on-site HAZMAT teams or fire brigades (Incident Commander) with all available knowledge about the emergency situation upon their arrival to the scene.

4.6.11 Employees Who Remain to Operate Critical Site Operations Before They Evacuate

All equipment and operations are required to cease in accordance with the established alarm signal procedures. The only exception will be related to health and safety:

- The SSO shall determine at the time of the emergency if health and safety will be jeopardized by immediate stoppage of any particular piece of equipment;

- If such a determination is made, personnel involved in critical operations shall be minimized. Once it is determined that the operation is no longer needed or the threat to the operators is imminent, operations will cease and the operators will immediately evacuate.

4.6.12 Rescue and Medical Response

- Only currently trained individuals will administer first aid, CPR or an AED. Refer to *S3AM-012-PR1 First Aid*.
- In the event of an incident, refer to material's SDS labels to confirm proper first aid is administered for the hazardous material and call the nearest Poison Centre or 911. Refer to *S3AM-012-PR1 First Aid*.
    - The American National Standards Institute (ANSI) Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-1998) recommends that the affected body part shall be flushed immediately and thoroughly for at least 15 minutes using a large supply of clean fluid under low pressure. However, other references recommend a minimum 20-minute flushing period if the nature of the contaminant is not known. The flushing or rinsing time can be modified if the identity and properties of the chemical are known. For example, at least:
        - 5 minutes flushing time for mild irritants;
        - 20 minutes for moderate to severe irritants;
        - 20 minutes for non-penetrating corrosives;
        - 60 minutes for penetrating corrosives;
        - If irritation persists, repeat the flushing procedure.
- It is important to note that ingestion of any chemical is not likely to occur in the workplace. If ingestion does occur, evidence indicates that inducing vomiting is not necessary in most situations where there has been an occupational chemical ingestion.
    - Induction of vomiting should only be recommended if the chemical has very high, short-term (acute) toxicity, and medical follow-up is not readily available;
    - In these cases, first aiders should receive special training on how to safely and effectively induce vomiting in the appropriate circumstances.
- If the injury is life threatening, the Emergency Medical System (EMS) should be called (911). Depending on the procedures established for the project, the SSO would contact an emergency responder directly or notify the facility representatives for medical assistance;
- If the employee needs medical attention that cannot be provided on-site, the SSO shall escort the individual to the local hospital identified on the emergency reference sheet and shall remain with the person until release or admittance is determined. The escort will relay all appropriate medical information to the Manager and SH&E Manager.

4.6.13 On-site and Off-site Communications

Regardless of the size or location of AECOM's field projects, it is extremely important that both on-site and off-site communications be maintained so that in the event of an emergency employees can contact each other or place a phone call immediately with the appropriate responder(s).

A reliable and approved form of communication (e.g. two way radio, cell phone, etc.) is required when members of the field team are working in separate areas of the site and verbal communications are no longer effective because of distance. A communication device shall be available for each team that is working in a separate area of the site.

When AECOM is working at an occupied facility, a telephone may be accessible. When AECOM is working on abandoned properties or when there is no access to a phone, as appropriate, a cellular telephone, two-way radio, or satellite telephone shall be brought to the work location.

4.6.14 Preferred Means of Reporting

Employees shall immediately notify the Supervisor of incidents and emergencies, and report in accordance with *S3AM-004-PR1 Incident Reporting, Notification & Investigation*:

- Unless facility representatives specifically indicate that they prefer AECOM personnel to notify them first of an emergency, the SSO will directly contact the appropriate emergency responders listed on the Location Specific Emergency Response Plan;
- Additional communications within AECOM concerning an emergency event may be required as per *S3AM-010-PR1 Emergency Response Planning* and *SR1-003-WI2 Disruptive Event Response Instruction*;
- "Dangerous occurrences" shall be reported immediately to the police, employer, vehicle owner/leaser and the dangerous goods owner. Such events would include spills, bulk container damage, fire, explosion, and transportation accidents involving dangerous goods;
- Confirm and seek direction on external reporting requirements. Each jurisdiction has regulations governing the minimum quantities for reporting based on the type of product spilled or release refer to *S3AM-117-ATT1 Spill Notification Numbers for North America*;

Individuals who have knowledge of a spill, release, or unlawful discharge, shall notify authorities immediately. Reporting does not imply guilt or assign blame. The following details are to be reported:

- Location and time of spill;
- Description of circumstances leading to spill;
- Type and quantity of material or substance spilled;
- Details of any action taken at the site of the spill;
- Description of location of spill and immediately surrounding the area;
- Any additional information in respect of the spill that the Minister, Environmental Protection Officer or person designated by regulations requires.

4.6.15 First Responder

First responders shall have sufficient training or have had sufficient experience to objectively demonstrate competency in the following areas:

- An understanding of what hazardous substances are, and the risks associated with them in an incident;
- An understanding of the potential outcomes associated with an emergency;
- The ability to recognize the presence of hazardous substances and physical hazards in an emergency;
- An understanding of the role of the first responder;
- The ability to realize the need for additional resources and to make appropriate notifications to the communication center.

4.6.16 First Responder HAZWOPER Operations Level

First responders at the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response to the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release:

- They are trained to respond in a defensive fashion without actually trying to stop the release; Their function is to contain the release from a safe distance, keep it from spreading, and prevent exposures;

- First responders at the operational level shall have received at least eight hours of training or have had sufficient experience to objectively demonstrate competency in the following areas in addition to those listed for the awareness level and the employer shall so certify:
    - Knowledge of the basic hazard and risk assessment techniques;
    - Know how to select and use proper personal protective equipment provided to the first responder operational level;
    - An understanding of basic hazardous materials terms;
    - Know how to perform basic control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with their unit;
    - Know how to implement basic decontamination procedures;
    - An understanding of the relevant standard operating procedures and termination procedures;

4.6.17 Hazardous Materials Technician

Hazardous materials technicians shall have received at least 24 hours of training equal to the first responder operations level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the employer's emergency response plan;
- Know the classification, identification, and verification of known and unknown materials by using field survey instruments and equipment;
- Be able to function within an assigned role in the Incident Command System, refer to *Federal Emergency Management Agency—FEMA: Incident Command System*;
- Know how to select and use proper specialized chemical PPE provided to the hazardous materials technician;
- Understand hazard and risk assessment techniques;
- Be able to perform advance control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available with the unit;
- Understand and implement decontamination procedures;
- Understand termination procedures;
- Understand basic chemical and toxicological terminology and behavior.

4.6.18 Hazardous Materials Specialist

Hazardous materials specialists shall have received at least 24 hours of training equal to the technician level and in addition have competency in the following areas and the employer shall so certify:

- Know how to implement the local emergency response plan;
- Understand classification, identification, and verification of known and unknown materials by using advanced survey instruments and equipment;
- Know the state or applicable jurisdictional emergency response plan;
- Be able to select and use proper specialized chemical PPE provided to the hazardous materials specialist;
- Understand in-depth hazard and risk techniques;
- Be able to perform specialized control, containment, and/or confinement operations within the capabilities of the resources and personal protective equipment available;

- Be able to determine and implement decontamination procedures;
- Have the ability to develop a site safety and control plan;
- Understand chemical, radiological, and toxicological terminology and behavior.

4.7 Decontamination Procedures

4.7.1 When possible, all necessary steps shall be taken to reduce or minimize contact with chemicals and impacted materials while performing field activities (e.g., avoid sitting or leaning on, walking through, dragging equipment over, tracking, or splashing potential or known impacted materials).

4.7.2 All personal decontamination activities shall be performed with an attendant (buddy) to provide assistance to personnel that are performing decontamination activities. An attendant may not be required for Level D equipment removal and decontamination. Depending on specific site hazards, attendants may be required to wear a level of protection that is equal to the required level in the exclusion zone.

4.7.3 All persons and equipment entering the EZ shall be considered contaminated, and thus, shall be properly decontaminated prior to entering the SZ. No equipment, including personal protective equipment or contaminated clothing shall be taken or worn into the SZ.

4.7.4 Decontamination procedures may vary based on site conditions and nature of the contaminant. If chemicals or decontamination solutions are used, care should be taken to minimize reactions between the solutions and contaminated materials. In addition, personnel shall assess the potential exposures created by the decontamination chemical(s) or solutions. The safety data sheets shall be reviewed, implemented, and filed by personnel contacting the chemicals/solutions.

4.7.5 All contaminated personal protective equipment (PPE) and decontamination materials shall be stored and disposed of in accordance with site-specific requirements identified in the approved work plan.

4.7.6 For all Level A and B ensembles, adequate supplied air shall be available to allow the employee to safely complete all necessary decontamination steps.

4.7.7 Where decontamination procedures involving radioactive materials are required, the removable limits for both personnel and equipment will be specified by a Certified Health Physicist or Certified Industrial Hygienist in the project's approved Radiation Protection Plan or approved safety planning document.

4.7.8 Materials Needed to Decontaminate Personnel and/or Equipment

- The equipment required to perform decontamination may vary based on site-specific conditions and nature of the contaminant(s). The following equipment is commonly used for decontamination purposes:
    - Soft-bristle scrub brushes or long-handled brushes to remove contaminants;
    - Hoses, buckets of water or garden sprayers for rinsing;
    - Large plastic/galvanized wash tubs or children's wading pools for washing and rinsing solutions;
    - Large plastic garbage cans or similar containers lined with plastic bags for the storage of contaminated clothing and equipment;
    - Metal or plastic cans or drums for the temporary storage of contaminated liquids;
    - Paper or cloth towels for drying protective clothing and equipment; and
    - Poly or plastic sheeting to lay down and form the base for the CRZ, as well as to contain contaminants and decontamination fluids.

4.7.9 Personal Decontamination Steps

- The decontamination plan shall be in writing and shall specify the exact steps in either wet or dry decontamination or personnel exiting the EZ to the SZ. The decontamination plan shall also address respirator cartridge change out, SCBA bottle changes and equipment decontamination.

4.7.10 Decontamination Steps during a Medical Emergency

- If decontamination can be done:
  - Wash, rinse and/or cut off protective clothing and equipment.
- If decontamination cannot be done:
  - Wrap the victim in blankets, plastic sheeting, or rubber to reduce contamination of other personnel;
  - Alert emergency and offsite medical personnel to potential contamination;
  - Instruct them about specific decontamination procedures if necessary;

4.7.11 Equipment Decontamination Steps

- All equipment leaving the EZ shall be considered contaminated and shall be properly decontaminated to minimize the potential for exposure and off-site migration of impacted materials. Such equipment may include, but is not limited to: sampling tools, heavy equipment, vehicles, PPE (hoses, cylinders, etc.), and various handheld tools;
- All Employees performing equipment decontamination shall wear the appropriate PPE to protect against exposure to contaminated materials. The level of PPE may be equivalent to the level of protection required in the EZ. Other PPE may include splash protection, such as face-shields and splash suits, and knee protectors. Following equipment decontamination, Employees may be required to follow the proper personal decontamination procedures above;
- For larger equipment, a high-pressure washer may need to be used. Some contaminants require the use of a detergent or chemical solution and scrub brushes to confirm proper decontamination. Personnel operating a high pressure washer will be trained in the operation of the equipment and follow the manufacturer's operational instructions;
- For smaller equipment, use the following steps for decontamination:
  - Remove majority of visible gross contamination in EZ;
  - Wash equipment in decontamination solution with a scrub brush and/or power wash heavy equipment;
  - Rinse equipment;
  - Visually inspect for remaining contamination;
  - Follow appropriate personal decontamination steps outlined above.
- All decontaminated equipment shall be visually inspected for contamination prior to leaving the CRZ. Signs of visible contamination may include an oily sheen, residue or contaminated soils left on the equipment. All equipment with visible signs of contamination shall be discarded or re-decontaminated until clean. Depending on the nature of the contaminant, equipment may have to be analyzed using a wipe method or other means.

4.8 Employee Exposure Monitoring

4.8.1 Explosive levels, oxygen levels, and airborne contaminants may present potential hazards to HAZWOPER personnel working within controlled work areas and to non-HAZWOPER workers and the general public present outside the controlled work areas.

4.8.2 As appropriate, exposure monitoring at HAZWOPER sites will be conducted to determine explosive and oxygen levels, monitor and control employee exposures to airborne contaminants, and to determine and regulate controlled work area boundaries (e.g., support zone, contamination reduction zone, and exclusion zone) for the protection of non-HAZWOPER workers and the general public.

4.8.3 Specific exposure monitoring requirements will be established in individual SH&E Plans. Refer to *S3AM-127-PR1 Exposure Monitoring*. All monitoring efforts using direct reading instruments and will remain part of the project file.

4.8.4 Work Area Exposure Monitoring

- Work area exposure monitoring will include breathing zone readings for the maximum exposed worker(s);
- Results will be used to determine adequacy of PPE (especially respiratory protection). Specific criteria for upgrade/downgrade will be established in the SH&E Plan.

4.8.5 Perimeter Exposure Monitoring

- Perimeter air samples will be collected when the potential exists for airborne contaminants to migrate off-site and will be collected near the work zones when performing work at an active client facility. Refer to *S3AM-127-PR1 Exposure Monitoring*;
- Perimeter exposure monitoring will be conducted at locations downwind from the project activities at a minimum (also upwind if the potential exists for offsite contamination to migrate onto the site).

4.8.6 Exposure results will be posted on site and explained in a safety briefing.

4.8.7 Employees will receive a written statement of results within 15 days of receipt from the laboratory.

4.8.8 Results of all personal exposure monitoring will be provided to the SH&E department for inclusion in the employee medical records, refer to *S3AM-017-PR1 Injury & Illness Recordkeeping*.

5.0 Records

5.1 All forms and documents generated during a HAZWOPER project will be maintained in the project file.

5.2 All medical screening and surveillance documentation shall be retained for 30 years.

6.0 Attachments

6.1 S3AM-117-ATT1 Spill Notification Number for North America

Americas

Non-Ionizing Radiation

S3AM-121-PR1

1.0 Purpose and Scope

1.1 Provides the requirements and guidelines to control occupational and public exposure to non-ionizing radiation, including lasers and radiofrequency (RF), infrared (IR), and ultraviolet (UV) radiation.

1.2 This procedure applies to all AECOM Americas employees and operations, and any other entity and its personnel contractually required to comply with this document's content, except where local or governmental regulations are more stringent.

2.0 Terms and Definitions

2.1 **Controlled Environment** – An area where the occupancy and activity of those within is subject to control and supervision for the purpose of protection from radiation hazards.

2.2 **Hazard Distance** – Distance from a radiofrequency emitter at which the power density equals the Uncontrolled Environment Maximum Permissible Exposure Limit power density level as established by the latest edition of the ANSI C95.1.

2.3 **ANSI Z136.1 Safe Use of Lasers**– American National standard issued applicable to the safe use of lasers and laser systems emitting laser radiation in the wavelength range 180 nanometres to 1 millimetre. The standard defines the classification of lasers (Class 1, 1M, 2, 2M, 3R, 3B and 4) based on Accessible Emission Limit (AEL) and viewing conditions.

2.4 **Infrared (IR)** – Electromagnetic radiation having a wavelength just greater than that of the red end of the visible light spectrum but less than that of microwaves. Infrared radiation has a wavelength from about 800 nm to 1 mm, and is emitted particularly by heated objects

2.5 **Laser –** An acronym for Light Amplification by Stimulated Emission of Radiation.

2.6 **Maximum Permissible Exposure (MPE) Limits** – The level of exposure which is considered as the limit between safe and potentially harmful.

2.7 **Non-ionizing Radiation** – Any type of electromagnetic radiation that does not carry enough energy to ionize atoms or molecules. Examples include radiofrequency radiation, microwave radiation, ultraviolet radiation, visible light, infrared radiation, lasers, static electric and magnetic fields, etc.

2.8 **Radio frequency (RF)** – Any of the electromagnetic wave frequencies that lie in the range extending from around 3 kHz to 300 GHz, and includes frequencies used for communication signals (e.g. radio, cell-phone, etc.) or radar signals.

2.9 **Ultraviolet (UV)** – Electromagnetic radiation having wavelengths between that of ordinary, visible violet light that of x-rays. Ultraviolet radiation is made up of three types of rays; A (UVA), B (UVB), and C (UVC). UV radiation is present in sunlight, and also produced by electric arcs and specialized lights (e.g. mercury-vapor lamps, black lights).

2.10 **Uncontrolled Environment** – Locations where there is the exposure of individuals who have no knowledge or control of their exposure.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-120-PR1 Radiation

3.3 S3AM-128-PR1 Medical Screening & Surveillance

3.4 S3AM-208-PR1 Personal Protective Equipment

3.5 S3AM-209-PR1 Risk Assessment & Management

3.6 S3AM-325-PR1 Lockout Tagout

3.7 S3AM-332-PR1 Hot Work

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Corporate SH&E Management System & Prequalification Manager**

The SH&E Department will maintain this procedure and include it in the annual review of the AECOM Americas SH&E procedures.

4.1.2 **SH&E Manager (or designee)**

The SH&E Manager will provide technical guidance to projects that involve the use/survey of non-ionizing sources as well as identifying the proper controls to mitigate employee exposure to non-ionizing radiation sources, including UV radiation. In addition, SH&E Managers will:

- Review and approve all exposure plans, such as Non-Ionizing Radiation Protection Plans (NIRPP);
- Conduct non-ionizing radiation hazard assessments;
- Confirm applicable awareness training on non-ionizing radiation hazards is available to project teams. Refer to *S3AM-003-PR1 SH&E Training*;
- Authorize the use of a Class 3B and 4 lasers.

4.1.3 **Manager**

Managers are responsible for the overall safety and planning for a project. Managers are also responsible for:

- Verifying that the presence of non-ionizing radiation sources at project work sites are identified in the applicable SH&E Plan and Task Hazard Assessment (THA) prior to commencing field activities;
- Addressing and controlling potential non-ionizing radiation hazards through consultation with the SH&E Manager, subject matter experts (as appropriate), and/or development of a NIRPP;
- Verifying incident and injury reporting procedures are followed when a suspected overexposure to non-ionizing radiation, an incident of sunburn, or other excessive non-ionizing radiation exposure occurs in the workplace;
- Monitoring employee compliance with the requirements of this policy;
- Confirming employees complete non-ionizing radiation awareness training as directed by the SH&E Manager.

4.1.4 **Employee**

- Will not disturb or handle any non-ionizing radiation sources or work in any identified non-ionizing radiation hazard area (e.g.., Controlled Environment) without appropriate training and safety procedures;
- Will work in accordance with all established manufacturer, client, and NIRPP requirements;
- Will identify both known and suspected non-ionizing radiation sources on the THA and report any change in site conditions related to non-ionizing radiation sources to the Manager;
- Will immediately notify the Manager of the presence or suspected presence of previously unidentified non-ionizing radiation sources in the workplace, and cease all work activities involving potential exposure to non-ionizing radiation until further direction is received;
- Will use suitable personal protective equipment to the non-ionizing radiation hazards.

4.2 Hazard Assessment

4.2.1 AECOM will identify and assess the hazards associated with work where the potential exists for employees to be exposed to laser radiation or other non-ionizing radiation sources, develop appropriate elimination and control measures, and document this in the location or project specific SH&E Plan.

- If routine exposures to laser radiation or other non-ionizing radiation sources are expected, an appropriate plan, such as a Non-Ionizing Radiation Protection Plan (NIRPP) should be developed. The plan (e.g. NIRPP) may be included in the location or project specific SH&E Plan;
- Consultation with subject matter experts may be necessary depending upon the extent, number, and type of non-ionizing radiation (e.g., Laser Safety Officer);
- Task specific hazards and associated controls shall also be identified in the respective THA;
- Refer to *S3AM-209-PR1 Risk Assessment & Management*.

4.2.2 In addition to the SH&E Plan, appropriate personal protective equipment will be identified and documented in the THA or other relevant hazard assessment documentation.

4.2.3 AECOM will develop and implement an appropriate NIRPP to control identified hazards where the potential to exceed the applicable Maximum Permissible Exposure (MPE) limits exist.

4.3 Laser Protection Requirements

4.3.1 Only qualified and trained employees will be assigned to install, adjust, and operate laser equipment for surveys, alignment/grade-checks, tunnel work, etc.

4.3.2 Laser equipment will bear a label to indicate maximum power output, ANSI class, and beam spread.

4.3.3 Looking into the primary beam is prohibited, and care will be taken to avoid looking at specular reflections of the beam, including those from lens surface work.

4.3.4 Where direct or reflected laser light greater than 0.005 watts (5 milliwatts) for ≥ ¼ second exists, employees will be provided with laser safety goggles that will protect them for the specific wavelength of the laser and be of an optical density (OD) adequate for the energy involved. The laser safety goggles will be selected in accordance with the requirements of ANSI Z136.1-2014 (or the most current edition).

4.3.5 Operation of an ANSI Class 3B or 4 laser should be assessed for exposure hazards and whether medical surveillance is appropriate. Refer to *S3AM-128-PR1 Medical Screening & Surveillance*.

4.3.6 Use of an ANSI Class 4 laser requires the approval of the SH&E Manager.

4.3.7 All protective goggles will bear a label identifying the following data:

- The laser wavelength for which use is intended;
- The optical density of that wavelength;
- The visible light transmission.

4.3.8 Class 1 Lasers

- Safe for the unprotected eye and through optical instruments (prescription lenses, telescopes, beam reducers, etc.);
- Very low power lasers or enclosed lasers;
- MPE is never exceeded, even for very long exposure (hours), or with the use of optical instruments;
- Nominal Hazard Zone: none.

4.3.9 Class 1M Lasers

- Safe for the unprotected eye only, but potentially hazardous when optical instruments are used;
- Medium power lasers either collimated with a large beam or highly divergent;
- MPE can be exceeded when using optical instruments;
- Nominal Hazard Zone: none for the unprotected eye.

4.3.10 Class 2 Lasers

- Safe for unintended exposure, (less than 0.25 seconds) but hazardous when looking at for more than 0.25 seconds;
- Visible (wavelength of 400–700 nanometers) low power lasers;
- MPE is not exceeded provided the viewings are accidental only. MPE calculation assumes the blink reflex will stop the light after 0.25 second;
- Nominal Hazard Zone: none for accidental exposure.

4.3.11 Class 2M Lasers

- Safe for the unprotected eye when the exposure is unintended, (less than 0.25 seconds) but hazardous when looking at for more than 0.25 seconds or when optical instruments are used;
- Visible (wavelength of 400–700 nanometers) medium power lasers either collimated with a large beam or highly divergent;
- MPE is not exceeded provided the viewings are accidental only and only with unprotected eyes. MPE calculation assumes the blink reflex will stop the light after 0.25 seconds. Using optical instruments might bring the exposure above the MPE as well;
- Nominal Hazard Zone: none for accidental exposure to the unprotected eye.

4.3.12 Class 2M Lasers and Greater

- Areas where a Class 2M or higher, non-enclosed path laser beam is in use will be posted with standard laser-warning placards;
- Beam shutters or caps will be used, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a period of time (e.g., >5 minutes), such as during the lunch hour, overnight, or at change of shifts, the laser will be turned off;
- Only mechanical or electronic means will be used as a detector for guiding the internal alignment of the laser. Aligning the laser with the unprotected eye is prohibited;
- The laser beam will not be directed at employees. Laser units will be set above or below the heads of employees;
- Employee exposure will be controlled to stay within the MPE limits specified in ANSI Z136.1-2014 (or the most current edition).

4.3.13 Class 3R Lasers

- Unsafe, except when handled carefully by experienced users. Accidental short exposure is considered as a small hazard;
- Low power lasers;
- MPE can be exceeded up to 5 times;
- Nominal Hazard Zone: hazard area for the eye, none for the skin.

4.3.14 Class 3B Lasers

- Unsafe without exception, laser safety goggles shall be worn within the nominal hazard zone. Focused lasers of this class are a potential fire hazard;

- Medium power lasers;
- MPE is exceeded more than 5 times. Skin MPE is not generally exceeded, except at focus;
- Nominal Hazard Zone: hazard area for the eye, none for the skin.

4.3.15 Class 4 Lasers

- Dangerous, Personal Protective Equipment (PPE) for eyes and skin shall be worn within the nominal hazard zone. Class 4 lasers are fire hazards as well. Diffuse reflections may be hazardous;
- High power lasers;
- Ocular and skin MPE are exceeded. Diffuse reflections exceed the MPE;
- Nominal Hazard Zone: hazard area for the eye and for the skin.

4.4 Radiofrequency Radiation Protection

4.4.1 Reduction in radiofrequency (RF) exposures can be accomplished through the implementation of appropriate administrative, work practice and engineering controls. Should routine occupational RF exposures be part of a project, a suitable plan shall be developed such as an NIRPP.

4.4.2 Generally, where RF emitters are identified, employees will:

- Remain outside any demarcated area where an RF hazard exists;
- Remain within the General Public exposure region;
- If the preceding requirements cannot be met or determined, AECOM will obtain a hazard assessment from the emitter's operator for controlling entity and provide it to the SH&E Manager for evaluation and determination of the relevant hazard mitigation measures.

4.4.3 If the above information is not available, an RF emitter survey will be required to assess the potential exposure hazards. An RF emitter survey shall be performed by an individual trained to effectively assess RF exposures.

4.4.4 Unless using an RF meter under the direction of an individual trained to effectively assess RF exposures, employees will not enter any area which is located within the RF hazard distance identified by the RF emitter survey. AECOM personal may enter a controlled area if the emitter has been de-energized and locked-out using standard Lockout/Tagout procedures in accordance with *S3AM-325-PR1 Lockout Tagout.*

4.5 Infrared Radiation Protection

4.5.1 Infrared (IR) radiation may be encountered during furnace operations, pouring, casting, hot dipping, laser and high-intensity light sources, curing, annealing and plastic welding.

4.5.2 Performance of welding and oxygen/acetylene cutting operations (torch cutting, brazing, welding) involves the use of an exposed high-temperature flame. This flame produces infrared (IR) radiation and UV radiation at the welding location which can cause cataracts, skin cancer, and thermal burns to the welder or other persons located nearby.

4.5.3 Skin Protection

- Long sleeve, flame-resistant shirts and/or forearm length Nomex gloves will be worn;
- Leather welder's apron or equivalent protection;
- Long pants shall be worn during any hot work task;
- Welding screens shall be utilized where feasible to protect the general public or other unprotected employees.

4.5.4 Eye Protection

- A welder's helmet or goggles with the appropriate lens shade will be worn. Refer to

S3AM-208-PR1 Personal Protective Equipment.

4.6 Ultraviolet Radiation Protection

4.6.1 Broad-spectrum UV radiation is classified as a known human carcinogen. UV radiation can cause harmful effects from both chronic and acute exposures including reddening of the skin (regardless of skin tone), accelerated skin aging, and damage to the eyes (e.g., cataracts, retinal burns, or welder's flash), and sunburn. Employees may be exposed to UV radiation from natural sunlight or manmade sources such as germicidal lamps (e.g., UV groundwater treatment systems) and welding.

4.6.2 While not required, the completion of an exposure or UV risk assessment will assess the risk posed by UV at the site. Such an assessment can be included in the SH&E plan and as part of a Task Hazard Assessment (THA). Special consideration should be given to work activities at higher elevations as the intensity of UV exposures are significantly higher than at lower elevations. Typically, UV exposure can increase 4-5% for every 1000 feet ascended. Also, some medications (e.g., Tetracycline) can increase sensitivity to UV exposure.

4.6.3 Control measures will be implemented at a worksite according to the conditions and work performed.

4.6.4 Engineering Controls

- Operations producing IR or UV radiation may be segregated or separated from other operations (e.g. use of automated systems, walls, screens, etc.);
- Employees will be encouraged to maximize use of the shade provided by trees, buildings, and other structures;
- Where there is limited access to natural shade, fixed or portable shade structures will be provided where practical;
- It is acknowledged that the provision of shade does not provide total protection from UV; therefore, it is recommended that outdoor workers adopt personal protection strategies such as protective clothing, sunscreen, and the wearing of hats in addition to using shade.

4.6.5 Administrative Controls

Consideration will be given to the reorganization of outdoor work programs to reduce UV exposure including, but not limited to:

- Use of the UV Index to assess UV hazards;
- Rescheduling work hours to enable workers to start earlier during May-September;

The UV Index, shown in Table 1, can help employees be aware of the expected level of UV radiation exposure on any given day.

Table 1. UV Index

Exposure Category	Index Number	Sun Protection Messages
Low	< 2	Wear sunglasses on bright days. In winter, reflections off of snow can nearly double UV strength. If you burn easily, cover up and use sunscreen.
Moderate	3-5	Take precautions, such as covering up and using sunscreen.
High	6-7	Protection against sunburn is needed.
Very High	8-10	Take extra precautions. Unprotected skin will be damaged and can burn quickly.
Extreme	11+	Take all precautions. Unprotected skin can burn in minutes.

4.6.6 Personal Protective Equipment

Employees who work outdoors shall provide and utilize personal outer clothing (e.g. shirt and trousers) that meets the established general clothing requirements per *S3AM-208-PR1 Personal Protective Equipment*. For those circumstances where the outer clothing requirements exceed the general clothing requirements, AECOM will provide the necessary clothing. The selection of appropriate protective clothing will take into account both the need to block UV and the need to reduce the effects of heat.

- Protective Clothing
    - Full length trouser pants and shirts that cover shoulders at a minimum (where practical, the fabric will have a close weave);
    - Where possible, clothing will be lightweight, loose fitting and have a collar;
    - Clothing and head wear with a sun (UV) protection factor (SFP) is encouraged but not required.
- Secondary hazards such as fire resistance will be considered.
- Head, Face, and Neck Protection
    - Hats provide shade and the larger the brim the greater the amount of shade that is provided;
    - Full brim hard hats are recommended (for additional protection, neck flaps are recommended);
    - In circumstances where the wearing of a broad-brimmed hard hat causes difficulties due to its size, sunscreen and other protective measures will be used.
- Eye Protection
    - Wrap-around, close-fitting, large safety glasses will reduce the amount of UV and glare that may pass around the edges of the glasses (the color or darkness of the lenses does not indicate the level of UV protection; therefore, verification with the manufacturer should be performed);
    - Safety glasses shall provide the level of protection appropriate to the potential non-ionizing radiation hazard exposures;
    - For hot work activities that may produce ultraviolet radiation, eye protection shall utilize the proper welding shade.
- Sunscreen
    - Sunscreen does not offer complete protection against the sun and should always be used in conjunction with other protective measures;
    - A broad spectrum and water-resistant sunscreen with a SPF of 30+, or a rating of no less than three stars, will be provided;
    - Expiration dates on the sunscreen will be regularly checked to confirm it has not expired per the manufacturer's instructions;
    - Sunscreen should be placed in an easily accessible location and employees instructed on the correct application and use;
    - Sunscreen should be generously applied to all areas of exposed skin at least 20 minutes before going outside and reapplied every two hours, or as needed by the work conditions.

4.7 Non-ionizing Radiation Training Program

4.7.1 Employees will receive training where the need for non-ionizing radiation control measures has been identified in the SH&E Plan and if developed, the Non-Ionizing Radiation Protection Plan.

4.7.2 Awareness training on the applicable non-ionizing radiation source will be provided to employees prior to the start of work in the area where the hazard exists as well as when employees are required to enter non-ionizing radiation Controlled Environments. Training curricula will be determined by the SH&E Department.

5.0 Records

5.1 Training records shall be maintained in accordance with *S3AM-003-PR1 SH&E Training.* RF emitter surveys will be maintained in applicable project files.

6.0 Attachments

6.1 None

Americas

Flammable & Combustible Liquids

S3AM-126-PR1

1.0 Purpose and Scope

1.1 This procedure applies to all AECOM Americas based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

1.2 The purpose of this procedure is to provide information regarding the proper storage, handling, and work practices associated with flammable and combustible liquids.

2.0 Terms and Definitions

2.1 **Flashpoint** – The minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid. The flash point is normally an indication of susceptibility to ignition.

2.2 **Safety can** – Safety can: an approved container, of not more than 5 gallons (18.9 liters) capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure

3.0 References

3.1 S3AM-011-PR1 Fire Protection

3.2 S3AM-115-PR1 Hazardous Material Communication

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-332-PR1 Hot Work

4.0 Procedure

4.1 Implementation of this standard is the responsibility of the AECOM manager directing activities of the facility, site, or project location.

4.2 Appoint a Responsible Person who will:

4.2.1 Determine if flammable or combustible liquids are stored on-site. Flammable liquids and combustible liquids are classified or categorized differently by jurisdiction. As a general definition that aligns the different classifications or categories, flammable and combustible liquids are any liquid that has a flashpoint at or below 199.4°F (93°C). Refer to *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications.*

4.2.2 Inspect storage areas monthly.

4.2.3 Monitor the quantity of flammable and combustible liquids on the site.

4.2.4 Review work practices involving flammable and combustible liquids.

4.2.5 Safety data sheets (SDS) for all hazardous substances, including flammable and combustible liquids, must be provided by vendors or subcontractors, and maintained on site. For more information, see *S3AM-115-PR1 Hazardous Material Communication*.

4.2.6 Furnish portable fire extinguishers in such quantities, sizes, and types as needed for the special hazards of operation and storage. For more information, see *S3AM-011-PR1 Fire Protection*.

4.3 Control flammable and combustible liquids entering the site by ordering only those materials and quantities needed to complete a job.

4.4 Cylinders – General Use & Transport

4.4.1 Open and close cylinder valves using the appropriate tools provided by the cylinder supplier.

4.4.2 Remove regulators and replace caps before transporting cylinders.

4.4.3 Do not roll or drop cylinders. Transport cylinders in a vertical and secured positing using a cylinder basket, cylinder cart or other secure equipment.

4.4.4 Do not use cylinders if the cap cannot be removed by hand. Do not use tools (e.g., hammer) to loosen caps. Tag the cylinder "Do Not Use" and return the cylinder to a designated storage area to be returned to the cylinder supplier.

4.5 General Storage

4.5.1 Use only approved containers, tanks, and pumping equipment for storage and handling of flammable and combustible liquids. Use approved (UL or FM) metal safety cans (with spring-closing lid and spout cover, and optional flash-arresting screen) for the handling and use of flammable liquids in 1- to 5-gallon (3.8- to 18.9-liter) quantities. For additional information, see *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications.*

4.5.2 Place all rags, waste, etc., soiled by combustible or flammable materials in tightly closed metal containers for daily disposal.

4.5.3 Take precautions, including proper ventilation, to prevent the ignition of flammable vapors. Sources of ignition include, but are not limited to: open flames; lightning; smoking; cutting and welding; hot surfaces; frictional heat; static, electrical, and mechanical sparks; spontaneous ignition; chemical reactions; and radiant heat.

4.5.4 Require approved personal protective equipment for all persons handling flammable or combustible liquids, as outlined by the appropriate SDS.

4.5.5 Train employees exposed to flammable or combustible liquids in the hazards of these materials; in their safe handling, use and disposal; in their protection from ignition sources; in the type, use, and placement of containers and cabinets; in the location of fire extinguishers; in the protection against toxic vapors; and in the procedures to follow in case of spill or fire.

4.6 Indoor Storage

4.6.1 Keep indoor storage of flammable liquids to a minimum. Do not store more than 25 gallons (95 liters) of flammable or combustible liquids outside of an approved storage cabinet.

4.6.2 Do not store flammable or combustible liquids in areas used for exits, stairways, or normally used for the safe passage of people.

4.6.3 Do not store more than of flammable and combustible liquids in a single flammable storage cabinet in excess of that specified by the applicable jurisdiction. Refer to *S3AM-126-ATT1 Flammable & Combustible Liquid Classifications*.

4.6.4 Do not store oxidizers and other reactive chemicals in flammable cabinets.

4.6.5 Up to three cabinets may be grouped together. Groups of cabinets must be separated by at least 100 feet (30.5 meters).

4.6.6 Conspicuously label all cabinets "Flammable — Keep Fire Away."

4.6.7 Indoor flammable liquid storage rooms must conform to NFPA codes, including requirements regarding fire ratings, spill containment, maximum capacity, electrical classifications, and ventilation requirements.

4.7 Outside Storage

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

4.7.2 Maintain a minimum distance of 50 feet (15.2 meters) between flammable and combustible storage areas and hot work activities. Refer to *S3AM-332-PR1 Hot Work*.

4.7.3 Grade the storage area in a manner to divert possible spills away from buildings, and curb or dike so as to contain entire volume of liquids and prevent spills from impacting soil or groundwater.

4.7.4 Keep the entire storage site free from accumulation of unnecessary combustible materials. Closely cut weeds and grass, and establish a regularly scheduled cleanup procedure for the whole area.

4.7.5 Maintain adequate access-ways to open-yard storage to allow access by fire-fighting equipment. Equipment that is blocking access must be manned at all times so that it may be readily moved if necessary.

4.8 Labeling and Signage

4.8.1 Post a "NO SMOKING OR OPEN FLAME" sign in all areas where flammable and combustible materials are stored, handled, and processed.

4.8.2 Require all containers and cylinders to be labeled with the contents and adequate hazard warnings per *S3AM-115-PR1 Hazardous Materials Communication.*

4.9 Use of Materials on Site

4.9.1 Use flammable and combustible liquids in a manner that is consistent with the label and SDS for the product.

4.9.2 Use only those amounts of materials needed for the job. Transfer of these materials to ready-to-use containers is encouraged.

4.9.3 Use personal protective equipment stated on the product label and SDS. For additional information, consult *S3AM-208-PR1 Personal Protective Equipment*.

4.9.4 For dispensing and/or fueling operations, ensure:

- Signs are posted with instructions on the dispensing or fueling process.
- Operators have been trained in the dispensing or fueling process.
- Equipment being refueled has the engine shut off prior to fueling.
- Smoking is prohibited in vehicle and equipment refueling areas.
- Adequate protection is provided to safeguard dispensing pumps from physical damage from vehicles.
- Dispensing nozzles have auto shut-off or self-closing valves and provisions for containing or controlling over-spillage.
- Heating equipment installed in lubrication or service areas, where flammable liquids are dispensed, is of an approved type, and where feasible, is installed at least 8 feet (2.4 meters) above the floor.
- Tank cars and trucks being loaded or unloaded and flammable storage tanks and systems are properly bonded and grounded.
- Transfer of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded).
- Proper PPE is required during the dispensing or fueling process. For additional information, see *S3AM-208-PR1 Personal Protective Equipment*; and *S3AM-126-FM1 Flammable and Combustibles Inspection.*

4.10 Spill Control

4.10.1 Have a written spill response plan in place before materials are stored or used on site.

4.10.2 Have spill clean-up materials in the vicinity of the materials being stored.

4.10.3 Clean up or respond to spills promptly according to applicable local, state, and federal regulations. This may require notification of authorities if a Reportable Quantity (RQ) is exceeded.

4.10.4 Move leaking cylinder to a ventilated area away from ignition sources. Do not attempt to repair a leaking cylinder. Contact the cylinder supplier to determine proper response methods.

4.11 Disposal

4.11.1 Keep solvent waste and flammable liquids in fire-resistant, covered containers until they are removed from the worksite.

4.11.2 Do not place flammable or combustible waste in municipal garbage.

4.11.3 Do not pour flammable or combustible liquids down drains or onto the ground.

4.11.4 Dispose of flammable or combustible hazardous materials with a licensed and approved hazardous material disposal company.

4.12 Inspection

4.12.1 Inspect flammable and combustible storage and use areas on a monthly basis.

4.12.2 Use *S3AM-126-FM1 Flammable & Combustibles Inspection* or equivalent to inspect the storage areas.

4.12.3 Inspect cylinder regulators, gauges, valves, hoses and connections before use. Any damaged equipment shall be tagged out-of-service.

4.13 Training

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

4.14 Compliance

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

5.0 Records

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

5.1.1 Location of the SDS inventory.

5.1.2 Completed *S3AM-126-FM1 Flammable & Combustibles Inspection* or equivalent.

6.0 Attachments

6.1 S3AM-126-ATT1 Flammable & Combustible Liquid Classifications

6.2 S3AM-126-FM1 Flammable & Combustibles Inspection

Americas

Electrical Safety

S3AM-302-PR1

1.0 Purpose and Scope

1.1 Outline the safe working requirements for working with and near electric equipment and installations to minimize and control electrical hazards such as electrical shock, arc flash, and electrical fires in the workplace.

1.2 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

1.3 As a general rule, AECOM employees shall not work on exposed, energized systems with a potential greater than 50 volts. This work should be performed by a qualified electrician.

2.0 Terms and Definitions

2.1 **Arc Flash –** A dangerous condition associated with the release of energy during an electrical arc.

2.2 **Arc Flash Analysis –** A mathematical determination of the energy released by an electric arc and the distance from the source that a flash hazard exists. The process for an Arc Flash Analysis is defined in National Fire Protection Act 70E of the National Electric Code and Canadian Standards Association Z462.

2.3 **Arc Rating** – The maximum incident energy resistance demonstrated by a material prior to breakdown or at the onset of a second-degree skin burn (expressed in cal/cm2).

2.4 **Circuit Protective Device –** A load-rated switch, circuit breaker, or other device specifically designed as a disconnecting means for opening, reversing, or closing of live circuits.

2.5 **Energized Electrical Equipment –** Electrically connected to or having a source of voltage.

2.6 **Flash Hazard –** A dangerous situation associated with the release of energy caused by an electric arc.

2.7 **Ground Fault Circuit Interrupter (GFCI) –** An electrical device that protects the users of all devices connected to it from electrical shock. The GFCI is part of the circuit or device in use and continuously measures the current in that circuit. If a leakage of current is detected, as in the case of an electrical short circuit, the circuit is opened at the GFCI and current cannot flow beyond the GFCI.

2.8 **Licensed Electrician –** A person who possesses the local licenses and certifications to work on electrical circuitry, panels or equipment if full compliance with local legislation.

2.9 **Portable Electric Equipment –** Cord- and plug-connected equipment and extension cords.

2.10 **Qualified Persons** – Individuals who have specific and documented training and has demonstrated skills and knowledge in the construction and operation of electric equipment and installations to avoid the hazards of working on or near energized electrical equipment. Qualified Persons shall have been specifically permitted to near exposed energized and parts. Even an experienced electrician is unqualified unless he or she knows the particular equipment and has received specific safety training on the potential hazards involved.

2.11 **Shock Hazard –** A dangerous situation associated with the possible release of energy caused by contact or approach to live parts**.**

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-202-PR1 Competent Person Designation

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-209-PR1 Risk Asssessment & Management

3.5 S3AM-218-PR1 Permit to Work

3.6 S3AM-305-PR1 Hand & Power Tools

3.7 S3AM-322-PR1 Overhead Lines

3.8 S3AM-325-PR1 Lockout Tagout

3.9 S3AM-410-PR1 Hazardous Energy Control

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager / Supervisor**

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

4.1.2 **SH&E Manager**

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

4.1.3 **Employees**

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

4.2 Training

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

4.2.2 Employees shall have reviewed and acknowledged the applicable SH&E plan specific to the project or location.

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

4.3 General Requirements

4.3.1 Electrical equipment installed to provide electric power and light at worksites (both temporary and permanent) shall contain markings durable to the expected environment to inform workers of the equipment's:

- Manufacturer, trademark, or party responsible for the equipment.
- Voltage, current, or wattage.
- Any other ratings as necessary.
- Equipment / installations not appropriately marked shall not be used.

4.3.2 Electrical outlets utilized to supply power for electrical equipment during field operations shall be of the three-wire grounding type. They should be tested for correct polarity and adequacy of the ground with a circuit analyzer. If it is determined that the outlet is incorrectly wired or inadequately grounded, it must not be used until serviced by a licensed electrician.

4.3.3 GFCI devices will be in place between the equipment and power source for all temporary circuits unless protected by an assured equipment grounding program as defined in this procedure (i.e., circuits that are not part of a permanently installed facility electrical system, such as on a construction site or temporary field installation).

4.3.4 Unqualified personnel are not permitted to work on electrical equipment unless it has been de-energized, verified as being free of hazardous energy and locked and tagged out in accordance with *S3AM-325-PR1 Lockout Tagout*.

- Electrical equipment that has been de-energized but not locked and tagged out shall be treated as energized.

4.3.5 After a circuit is de-energized by a circuit protective device, the circuit may not be repeatedly manually reenergized until it has been determined that the equipment and circuit can be safely energized.

4.3.6 Temporary or permanent light fixtures that present a shock or burn hazard shall be guarded.

4.3.7 Confirm power switches are properly labeled to identify what they control, unless this is clearly confirmed through switch proximity or location. Electric conductors shall be protected from damage.

4.4 Classified Locations

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

4.4.1 Class I Locations

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

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

1. In which ignitable concentrations of flammable gases or vapors may exist under normal operating conditions; or
2. In which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or

3. In which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

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

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

2. In which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or

3. That is adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

4.4.2 Class II Locations

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

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

1. In which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures; or

2. There mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes, or

3. In which combustible dusts of an electrically conductive nature may be present.

B. B. Class II, Division 2 location is a location in which:

1. Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures, and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or

2. Dust may be in suspension in the air as a result of infrequent malfunction of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

4.4.3 Class III Locations

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

A. Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.

B. Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.

4.5 Distribution System Setup

4.5.1 Under no circumstances shall electrical lines be routed through doorways, hatches, windows, or other openings.

4.5.2 Electric lines crossing work areas, personnel, or vehicular traffic areas shall be either fastened securely overhead (at a height that provides safe clearance for work operations), or protected by a cover capable of withstanding the imposed loads without creating a trip hazard.

4.5.3 Circuit breakers shall be labeled to indicate their use.

4.5.4 All circuit breaker panels shall have no openings or uncovered knockouts and shall be kept covered when not in use.

4.5.5 All live parts of electrical equipment operating at 50 volts or more shall be properly guarded against accidental contact.

4.5.6 Extension Cord Use

- Extension cords and electrical connections on handheld and other power tools will be inspected prior to use for cuts, kinks, frayed wires, etc. If any deficiency is noted, the equipment will be tagged “OUT OF SERVICE” and removed from service. Manufacturer-installed insulated electrical cords will not be repaired except by a licensed electrician.
- Extension cords are not to be placed across aisles, through doors, through holes in a wall, or in areas where the cord may be damaged or create a tripping hazard.
- Extension cord sets for use in field operations should be of the three-wire grounding type and will be rated for the intended load.
- Use of extension cords is allowed only for temporary installations not to exceed 90 days.
- “Daisy chaining” or connecting a series of extension cords together is not permitted.
- Extension cords shall be provided with a plug cap that is either molded to the cord or equipped with a cord clamp to prevent strain on the terminal screws.
- Extension cords shall not be fastened with staples or otherwise hung in a manner that could damage the outer jacket or insulation.
- Ground fault circuit interrupters shall be used or, if permitted by legislation, an “assured equipment grounding conductor program” is to be established for all nonpermanent wiring needed for construction purposes or when working outdoors, in wet or moist areas or elsewhere as required by legislation.

4.5.7 Temporary Lights/Task Lights

- A temporary light shall not be suspended by the cord unless the cord and light are designed for suspension.
- Temporary lights shall be equipped with bulb protectors unless they are installed at least 7 or more feet overhead.

4.6 Working on or Near Energized Parts

4.6.1 Working on or near energized parts covers either potential direct physical contact or contact by means of tools or equipment and working close enough to the energized part to draw an arc.

4.6.2 Any work on exposed, live electrical systems above 50 volts shall be conducted by a licensed electrician who is a Qualified Person.

4.6.3 Refer to *S3AM-302-ATT1 Live Electrical Work*.

4.6.4 Prior to performing any work near exposed, energized systems, the Qualified Person shall:

- Confirm with the Licensed Electrician that it is safe to do so.
- Perform a Shock Hazard Analysis.
- Perform an Arc Flash Analysis.
- Establish emergency contacts.

- Complete and have approved the Energized Electrical Work Permit. Refer also to *S3AM-218-PR1 Permit to Work* for additional guidance related to Safe Work Permits.
- Have all required personal protective equipment (PPE), insulated tools, and test equipment tested and ready to use.
- Know and understand the procedures to be followed.
- Ensure that adequate lighting and clearance space is available.
- Remove all conductive clothing and jewelry.

4.6.5 Working Near Overhead Power Lines

- Personnel working in the vicinity of overhead power lines, either on the ground or elevated, shall comply with *S3AM-322-PR1 Overhead Lines.*
- All workers and equipment including cranes and drill rigs shall maintain a clearance distance of at least 50 feet (15.24m meters) from overhead power lines unless a detailed assessment has been completed demonstrating that a smaller clearance distance provides protection.

4.7 Grounding

4.7.1 “Ground fault protection” is required on construction sites. To provide this protection, either “ground fault circuit interrupters” (GFCI) are to be used with temporary receptacles, or if permitted by legislation an “assured equipment grounding conductor program” is to be established in which plug-connected electrical equipment, extension cords, and temporary receptacles are tested on a periodic basis.

4.7.2 Ground Fault Circuit Interrupters

- A GFCI is an electrical device that is designed to prevent electrocution from electrical leakage. It is designed to measure the difference in amperage between the “hot” wire and the “neutral” wire in a circuit. Under ideal conditions, the amperage should be the same in both wires. If there is electrical leakage (a ground-fault), the amperages will be different. If the difference is more than a predetermined amount, the GFCI “trips” and stops the flow of electricity.
- GFCIs may trip from many causes including but not limited to:
    - Electrical leakage in the tool from internal defects, damaged insulation or from normal leakage in long runs of cords.
    - Moisture in the air or cords lying in water or on moist dirt.
    - Too many tools on one GFCI circuit.
    - Faulty wiring of the GFCI into the circuit.
    - Defective GFCI.
    - Any such tripping will require the problem to be corrected before the protected circuit can be re-set.

4.7.3 All 120-volt, single-phase, 15- and 20-ampere temporary receptacles shall be protected with “approved” GFCIs. “Approved” means listed by Underwriters Laboratories.

4.7.4 There are several types of GFCIs.

- A combination circuit breaker and GFCI that is installed in place of the ordinary circuit breaker.
- A receptacle containing a built-in GFCI.
- A portable GFCI that plugs into a receptacle and allows the extension cord or tool to be plugged into the GFCI.
- A portable unit containing several GFCI protected receptacles.

4.7.5 GFCIs contain a test button and a reset button. Each GFCI needs to be tested prior to use and on a periodic basis depending upon the manufacturer's recommendations (at a minimum monthly).

4.7.6 Assured Equipment Grounding Conductor Program

- If allowed by local legislation, assured equipment grounding conductor program is to be used instead of GFCIs to provide ground fault protection, the program shall be governed by the following requirements.
- Temporary receptacles shall be electrically grounded in accordance with the temporary wiring requirements of the National Electrical Code (United States)/Canadian Electrical Code.
- Extension cords shall be three-wire cords containing an equipment grounding conductor (ground wire).
- Electrical equipment that is plugged into a receptacle or extension cord (portable electrical tools, bench grinders, electric heaters, etc.) shall have a ground wire properly attached to the non-current-carrying metal parts of the equipment. (Double-insulated tools have no ground wire and are therefore exempt from these testing and recording requirements but still need to be inspected for defects.)
- The Manager or Supervisor is required to designate one or more competent persons to administer this testing and recording program. Refer to S3AM-202-PR1 Competent Person Designation.
- Periodic testing of all plug connected equipment, all extension cords, and all temporary receptacles is to be conducted at the following times:
    - Before a new item (equipment, cord, or receptacle) is put into use.
    - After any repairs to the item.
    - After any incident in which the item may have been damaged.
    - Within three months of the last test. (An exception is allowed in the Standard in which extension cords, and temporary receptacles, which are fixed in place and are not exposed to damage, may be tested every six months.)
- The purpose of the test is to determine the following:
    - Temporary receptacles—to be sure that the receptacle is grounded.
    - Extension Cords—to be sure that the ground wire is connected to the proper terminal at each end and that the ground wire is continuous throughout the length of the cord.
    - Plug Connected Equipment—to be sure that the ground wire is connected to the proper terminal and to the non-current carrying metal parts of the equipment and that the ground wire is continuous from the equipment to the plug.
- The tests may be conducted using the following instruments:
    - A receptacle tester may be used to test receptacles and to test extension cords when plugged into a receptacle.
    - A continuity tester, or a volt-ohm meter, may be used to test equipment and to test extension cords when not plugged into a receptacle.
- Records must be kept to show which items have passed the test and when the test was conducted. These records may be either written inspection logs, a color-coding system using colored tape attached to the item, or some other effective means.
- Color coding shall be used in the following manner:
    - After a plug-connected piece of equipment or an extension cord has been inspected and passed the test, colored tape is to be placed around the cord near the plug. After a temporary receptacle has passed the test, colored tape is to be placed on the cover plate.

- Any set of colors may be used, with the exception of white, black, or silver.
- If there has been no overall site requirements established by the general contractor, use the following colors for the test periods.

January, February, March	Red
April, May, June	Blue
July, August, September	Orange
October, November, December	Green

- The tests administered every three months are to begin on the first working day of each quarter. Testing and color coding are to be continued until all items covered by this program have been tested. The test administered every six months, for those receptacles and extension cords needing only semi-annual testing, are to be color coded using the quarterly color current at the time of the semi-annual test.
- A visual inspection of plug-connected equipment, extension cords, and temporary receptacles is to be made by the user before each use. The purpose of the visual inspection is to look for damage or defects that could affect the safe use of the item. (Exception: extension cords and temporary receptacles that are fixed in place and not exposed to damage are not required to be given a daily visual inspection, but it is a good idea to do the daily visual inspection anyway.)
- Equipment, cords, or receptacles showing damage or defects that could affect its safe operation are not to be used. This applies not only to the visual inspection before each use but also applies to any evidence of damage observed any time during use. Damaged items are to be taken out of service and are not to be used until properly repaired and retested.
- Equipment covered by this program is not to be used until the equipment has been tested and color coded according to the requirements of this program.
- A copy of this program is to be kept at the worksite.

4.8 PPE/Work Practices

4.8.1 PPE requirements shall be determined based on the results of each of the following: Task Hazard Analysis, Shock Hazard Analysis, and Arc Flash Analysis. Refer to the *S3AM-208-PR1 Personal Protective Equipment* and *S3AM-302-ATT1 Live Electrical Work*.

4.8.2 PPE

2 – Required PPE (range based on maximum voltage)	
50 to 240 volts	• **<u>Eye/Face</u>: Safety glasses with side shields or goggles and Arc-Flash Face Shield *or* Arc-Flash Suit Hood (4 cal/cm^2)** • **<u>Body</u>: Flame-Retardant long-sleeved shirt/pants or coverall (4 cal/cm^2)** • **<u>Hand</u>: Electrical Hazard (EH) gloves (Class 00 with leather protectors)** • **<u>Foot</u>: EH-rated footwear** • **<u>Head/Ears</u>: Class E hard hat, hearing protection (ear canal inserts)** • **<u>Tools:</u> ANSI/CSA-approved, voltage-rated**
Above 240 to 480 volts	• **<u>Eye/Face</u>: Safety glasses with side shields or goggles and Arc-Flash Face Shield and Sock Hood (8 cal/cm^2) *or* Arc-Flash Suit Hood (8 cal/cm^2)** • **<u>Body</u>: Flame-Retardant long-sleeved shirt/pants or coverall (8 cal/cm^2)** • **<u>Hand</u>: EH gloves (Class 00 with leather protectors)** • **<u>Foot</u>: EH-rated footwear** • **<u>Head/Ears</u>: Class E Hard hat, hearing protection (ear canal inserts** • **<u>Tools:</u> ANSI/CSA-approved, voltage-rated**

480 to 600 volts	• **Eye/Face: Safety glasses with side shields or goggles and Arc-Flash Suit Hood (8 cal/cm^2)** • **Body: Flame-Retardant long-sleeved shirt/pants or coverall (8 cal/cm^2)** • **Hand: EH gloves (Class 0 or higher with leather protectors)** • **Foot: EH-rated footwear (carbon fiber recommended)** • **Head/Ears: Class E Hard hat, hearing protection (ear canal inserts)** • **Tools: ANSI/CSA-approved, voltage-rated**

4.9 Portable Electrical Equipment

4.9.1 Refer to *S3AM-305-PR1 Hand & Power Tools*.

5.0 Records

5.1 The Shock Hazard Analysis and the Arc Flash Analysis forms shall be retained in the project file.

5.2 The completed *S3AM-302-FM1 Energized Electrical Work Permit* or equivalent shall be retained in the project file.

6.0 Attachments

6.1 S3AM-302-FM1 Energized Electrical Work Permit

6.2 S3AM-302-FM2 Electrical Hazard Checklist

6.3 S3AM-302-ATT1 Live Electrical Work

6.4 S3AM-302-ATT2 Generator Safety

Americas

Hand & Power Tools

S3AM-305-PR1

1.0 Purpose and Scope

1.1 This procedure provides the AECOM requirements for all manually operated hand and power tools and associated use, handling and storage. These requirements apply to tools provided by AECOM for employee use as well as tools provided by employees for use on AECOM work sites.

1.2 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-118-PR1 Hearing Conservation

3.3 S3AM-208-PR1 Personal Protective Equipment

3.4 S3AM-302-PR1 Electrical Safety

3.5 S3AM-325-PR1 Lockout Tagout

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers/Supervisors**

- Ensure that all aspects of this procedure are followed and adhered to on all AECOM projects, sites and locations.
- If a specific tool is not included in the work instructions related to this procedure, appropriate guidelines shall be established prior to work associated with that tool, including following manufacturer's recommendations.
- Ensure compliance with applicable client requirements and restrictions regarding hand or power tools.

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

- Provide technical guidance and support as to this procedure and associated work instructions.

4.1.3 **Employees**

- Work only with tools for which they are appropriately trained and familiar with.
- Follow manufacturer's recommendations for its use and never modify the equipment without first obtaining authorization from the manufacturer.
- Comply with applicable client requirements and restrictions regarding hand or power tools.

4.2 Requirements

4.2.1 Always conduct a task hazard assessment (THA) prior to work commencing and include the identified hazards associated with the anticipated tool use.

4.2.2 No employee shall use any hand or power tool, unless they are familiar with the use and operation of the equipment or have received specific instruction on its use and operation.

4.2.3 All tools will be used for which they were designed and in accordance with manufacturer's specifications. Do not use tools for jobs they are not intended for. For example, do not use a slot screw driver as a chisel, pry bar, wedge or punch or wrenches as hammers.

4.2.4 Use approved tools only. Never modify or use makeshift tools.

4.2.5 Do not apply excessive force or pressure on tools unless permitted by the manufacturer's specifications. This includes additional force by hammering with body weight, foot or other tools.

4.2.6 Keep surfaces and handles clean and free of excess oil and grease to prevent slipping.

4.2.7 Do not carry sharp tools (e.g. knife, chisel, screwdriver, etc.) in pockets; this practice may cause puncture wounds.

4.2.8 All tools shall be properly maintained. Clean, dry, lubricate and repair tools as applicable, and return to a suitable toolbox, room, rack, or other storage area upon completion of a job.

4.2.9 Ensure proper ergonomics principles are observed when using hand and power tools, such as but not limited to:

- Avoid static and awkward positions when possible.
    - Move at intervals to reduce muscle fatigue.
    - Consider tools with a trigger strip, rather than a trigger button. This strip will allow the exertion of more force over a greater area of the hand that, in turn, will reduce muscle fatigue
- Do not apply excessive force or pressure on tools.
- If possible use tools with comfortable grips that are designed to allow the wrist to stay straight. Avoid using a bent wrist.
- Choose hand tools that have a centre of gravity within or close to the handle.
- Frequently used tools that weigh more than 1 pound (0.45 kilograms) should be counter-balanced.
- Ensure proper body positioning when using a tool to prevent slips or falls in the event of unanticipated tool behaviour (slip, kickback, etc.). Avoid over-reaching.
- Pull on tools such as a wrench or pliers whenever possible. Loss of balance is more likely when pushing if the tool slips. If pushing is necessary, hold the tool with an open palm.
- Hand-arm vibration exposure is associated with the use of hand tools.
    - Reduce power to the lowest setting that can complete the job safely. This action reduces tool vibration at the source.
    - Consider the need for controls such as limiting time of use.
    - If safe to do so, adjust to a looser but stable grip, and use anti-vibration gloves.
- Use of heavy tools such as jackhammers can cause fatigue and strains. Heavy rubber grips can reduce these effects by providing a secure handhold.
- Do not increase a tool's leverage by adding sleeved additions (e.g. a pipe or snipe) to increase tool handle length.

4.2.10 Avoid placing fingers and hands in danger zones:

- Ensure hands and fingers have sufficient clearance in the event the tool slips.
- Ensure stability of the work-piece. Use work-piece holders (e.g. vise, chisel holder, etc.) whenever possible to prevent injury to hands or deflection of tool or work-piece.

- Use push sticks or guides when cutting or machining smaller material.

4.2.11 Secure tools when working from heights to prevent them from falling. Never leave tools on ladders, scaffolds, or overhead work areas when they are not in use.

4.2.12 Utilize good housekeeping practices to ensure tools do not present a tripping hazard.

4.2.13 Ensure no part of a tool extends over the edge of the bench top. Place sharp tools (e.g., saws, chisels, knives) on benches so that sharp points or edges face away from the edge.

4.2.14 When using saw blades, knives, or other tools, if possible direct the tools away from aisle areas and away from other employees working in close proximity.

4.2.15 Do not throw tools from place to place or from person to person, or drop tools from heights. Hand them, handle first, directly to other workers.

4.2.16 Use non-sparking and intrinsically safe tools in atmospheres with flammable or explosive characteristics and where highly volatile liquids, and other explosive substances are stored or used.

- Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools made of non-ferrous materials shall be used.
- Electrical tools shall be identified as intrinsically safe.

4.2.17 If the task presents electrical hazards, worker must be competent and use the appropriate insulated tools to perform work that includes the risk of electrical shock. Cushioned grip handles do not protect against electrical shock.

4.2.18 The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The exception to fire-resistant fluid involves all hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines. This hydraulic fluid shall be of the insulating type.

4.2.19 All tools designed to accommodate guards must have the guard(s) in place when the tool is in use. Do not modify, remove, or disable any machine guards.

4.2.20 Do not allow loose clothing, long hair, loose jewelry, rings, and chains to be worn while working with power tools.

4.2.21 Make provisions to prevent tools from automatically restarting upon restoration of power. Refer to *S3AM-325-PR Lockout Tagout*.

4.3 Training

4.3.1 Instruction in the proper use, safe handling, and maintenance of tools will be provided to employees unfamiliar with the tool.

- Assess the employee's training needs as per *S3AM-003-PR1 SH&E Training* procedure.
- Refer to the applicable work instructions associated with this procedure for any additional training specifics.
- Training shall include applicable manufacturer's recommendations and guidelines.

4.3.2 Employees shall demonstrate knowledge and competency in the use, safe handling and maintenance of the applicable tool prior to operation.

4.4 Personal Protective Equipment (PPE)

4.4.1 Utilize basic PPE appropriate to the task; gloves, safety-toed boots, hard hats and safety glasses with side shields. Refer to *S3AM-208-PR1 Personal Protective Equipment*.

4.4.2 Ensure lockout devices (padlocks, multiple lock hasps, tags) are utilized as necessary. Refer to *S3AM-325-PR Lockout Tagout*.

4.4.3 Ensure PPE is appropriate to the work and use additional PPE as required (e.g. mono-goggles, hearing protection, respiratory protection, etc.).

- Dual eye protection is required to be worn by any employee undertaking or within 3 ½ feet (1 meter) of a task that produces projected particles or material.
- Head and face protection is recommended for employees working with pneumatic tools.
- Noise hazard is associated with pneumatic and many other tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.

4.4.4 Screens shall also be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

4.4.5 Refer to the applicable work instructions associated with this procedure for any additional specialized PPE.

4.5 Inspections

4.5.1 All tools must be inspected prior to each use.

- Any tool that is defective or has missing parts must not be used.
- Every broken or defective tool must be tagged ‘out of service’ or ‘do not use’ and immediately removed from service.
- Tagged tools will be returned to the supervisor for repair or replacement.

4.5.2 All tools must be inspected to manufacture’s specifications and according to tool rests and guard adjustment tolerances. All tools will be inspected to ascertain that all safety devices are present and functioning properly. Refer to *S3AM-305-FM1 Hand & Power Tool Maintenance Inventory* and *S3AM-305-FM2 Hand & Power Tool Inspection Report*.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-305-ATT1 Chainsaw

6.2 S3AM-305-ATT2 Circular Saw

6.3 S3AM-305-ATT3 Cut Off Saw

6.4 S3AM-305-ATT4 Handheld Grinder

6.5 S3AM-305-ATT5 Impact Wrench

6.6 S3AM-305-ATT6 Nail Gun

6.7 S3AM-305-ATT7 Dustless Vacuum

6.8 S3AM-305-ATT8 Power Drill

6.9 S3AM-305-ATT9 Pressure Washer

6.10 S3AM-305-ATT10 Reciprocating Saw

6.11 S3AM-305-ATT11 Sander

6.12 S3AM-305-ATT12 Knives

6.13 S3AM-305-ATT13 Clearing & Grubbing Equipment

6.14 S3AM-305-ATT14 Pneumatic Tools

6.15 S3AM-305-ATT15 Manual Hand Tools

6.16 S3AM-305-ATT16 Small Engines

6.17 S3AM-305-ATT17 Electric & Battery Hand Tools

6.18 S3AM-305-FM1 Hand & Power Tool Maintenance Inventory

6.19 S3AM-305-FM2 Hand & Power Tool Inspection Report

Americas

Heavy Equipment Inspection Report

S3AM-309-FM13

TOOL	DATE	INSPECTED BY	RESULTS	ACTION REQUIRED	ACTION COMPLETED (DATE)

Americas

Heavy Equipment

S3AM-309-PR1

1.0 Purpose and Scope

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

1.2 Military related vehicles and equipment (e.g. tanks) are not covered under this standard.

1.3 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 **Heavy equipment** –All excavating equipment (e.g. scrapers, loaders, crawler or wheel tractors, excavators, backhoes, bulldozers, graders, agricultural and industrial tractors, etc.), cranes, lift trucks, drills, etc. This may include off-highway trucks (e.g. dump truck, heavy haul truck, etc.). For requirements related to crew trucks refer to *S3AM-005-PR1 Driving*.

2.2 **Operator** – Any person who operates the controls while the heavy equipment is in motion or the engine is running.

2.3 **Ground personnel/workers** – Personnel performing work on the ground around heavy equipment (note: operators are considered ground personnel when outside of the equipment cab).

3.0 References

3.1 S3AM-005-PR1 Driving

3.2 S3AM-202-PR1 Competent Person Designation

3.3 S3AM-213-PR1 Subcontractor Management

3.4 S3AM-303-PR1 Excavation

3.5 S3AM-322-PR1 Overhead Lines

3.6 S3AM-325-PR1 Lockout Tagout

3.7 S3AM-331-PR1 Underground Utilities & Subsurface Installation Clearance

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers / Supervisors**

- Responsible for confirming all equipment is in good working order and all equipment operators are verified as qualified on the piece of machinery they are assigned.
- As applicable, review as-built drawings.
- Maintain operation manuals at the site for each piece of equipment that is present on the site and in use.
- Maintain a list of operators for the project, and the specific equipment that they are authorized to operate.
- Prohibit equipment from being operated by any personnel who have not been specifically authorized to operate it.

- Confirm an equipment maintenance inventory is maintained, schedules adhered to and appropriate inspections of equipment are conducted.
- Confirm subcontractors are properly pre-qualified in accordance with *S3AM-213-PR1 Subcontractor Management.*
- Require that subcontractor employees follow established safety procedures in operation, inspection, and maintenance of vehicles and equipment.
- Inform AECOM and subcontractor machinery operators about applicable local regulations restricting the consecutive minutes of engine idling time allowed.
- Confirm subcontractor machinery and mechanized equipment is approved for use in accordance with the requirements of *S3AM-309-FM1 Approval of Machinery & Mechanized Equipment*.
- Confirm that all rented equipment bears any required current certification marks and arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.
- Confirm that AECOM and subcontractor machinery and mechanized equipment is certified, as applicable, in accordance with manufacturer specifications and/or regulatory requirements.
- Visually observe the subcontractors' vehicles and equipment, for any unsafe conditions or practices. Equipment or operation not in compliance with applicable safety standards is prohibited.

4.1.2 **Employees / Ground Personnel**

- Confirm that all rented equipment arrives in proper working order with the manufacturer's operating manual before acceptance from the supplier.
- Ground personnel when working in the vicinity of heavy equipment shall have received training, and comply with the applicable rules of engagement.

4.1.3 **Operators (of heavy equipment)**

- Operate the equipment safely, maintain full control of the equipment, and comply with manufacturer's operation manual and the laws governing the operation of the equipment.
- Inspect equipment and immediately report defects and conditions affecting the safe operation of the equipment to the appropriate Supervisor.
- Trainees may operate equipment in accordance with jurisdictional requirements and under the direct supervision of a trainer.

4.2 Communication

4.2.1 Communication between site Managers / Supervisors, heavy equipment Operators, and site Employees / Ground Personnel is a key method of preventing serious injury or death during heavy equipment operations.

4.2.2 Managers shall confirm the Industrial site or project specific SH&E Plan is developed and communicated to all affected and involved employees. Refer to *S3AM-209-PR1 Risk Assessment & Management*.

4.2.3 Task Hazard Assessments and Daily Tailgate meetings shall be conducted in accordance with *S3AM-209-PR1 Risk Assessment & Management.*

4.2.4 Concerning worksites in which other employers control concurrent operations and SH&E issues related to the worksite, the manager shall coordinate with those conducting concurrent operations to confirm appropriate control measures are in place to protect employees from the hazards associated with activities to be performed.

- Coordination shall occur prior to work commencing, periodically thereafter, and as necessary given changes in scope and/or working conditions.
- Affected employees (including managers and supervisors) shall seek to participate in all site SH&E meetings related to concurrent operations.

4.2.5 The following points outline the communication requirements during heavy equipment operations:

- Site Supervisors/t Managers shall confirm that all operators are notified/informed of when, where, and how many ground personnel will be working on site.
- Site Supervisors/ Managers shall inform all ground personnel before changes are made in the locations of designated work areas.
- Prior to work initiating on site, the Site Supervisor/ Manager is to confirm all operators and ground personnel are trained on the hand signals that will be used to communicate between operators and ground personnel.
- Ground Personnel working around heavy equipment operations are to maintain eye contact with operators to the greatest extent possible (always face equipment). Never approach equipment from a blind spot or angle.
- All heavy equipment whose backup view can be obstructed shall be equipped with reverse warning devices (e.g., backup alarms) that can be significantly heard over equipment and other background noise. Reverse signaling lights shall be in working order.
- When feasible, two-way radios shall be used to verify the location of nearby ground personnel.
- When an operator cannot adequately survey the working or traveling zone, a signal person shall use a standard set of hand signals to provide directions. Flags or other high visibility devices may be used to highlight these signals.

4.3 Ground Personnel

4.3.1 Ground clearance around heavy equipment may significantly reduce hazards posed during heavy equipment operations.

4.3.2 The following points outline the clearance requirements during heavy equipment operations:

- Ground Personnel shall always yield to heavy equipment.
- Ground Personnel shall maintain a suitable “buffer” area of clearance from all active heavy equipment.
- A task hazard assessment that identifies any special precautions shall be completed and communicated to all AECOM personnel associated with or affected by the activity.
- Site Supervisors/ Managers shall designate areas of heavy equipment operation and confirm that all ground personnel are aware of designated areas.
    - Designated areas shall include work zone boundaries and travel routes for heavy equipment.
    - Travel routes shall be set up to reduce crossing of heavy equipment paths and to keep heavy equipment away from ground personnel.
    - Work zone boundaries shall consider line of fire hazards related to the equipment and associated activities. Refer also to *S3AM-309-ATT2 Operator Line of Sight.*
    - If working near heavy equipment, Ground Personnel shall stay clear of loads to be lifted or suspended loads, and out of the travel and swing areas (excavators, all-terrain forklifts, hoists, etc.) of all heavy equipment.
    - During winch use, all swampers or other personnel will remain outside the “whip area” of the winch line or tow cable.

- At a minimum, employees shall maintain a distance of at least two pile lengths from where piles are being cut and dropped, other than in situations where cut piles are being guided to the ground utilizing mechanical means (e.g., pile driver and shackle) to control the direction and speed of fall of the cut pile.

- When feasible, Site Supervisors/ Managers shall set up physical barriers (e.g., caution tape, orange cones, concrete jersey barriers) around designated areas and confirm that unauthorized ground personnel do not enter such areas.
- Operators shall stop work whenever unauthorized personnel or equipment enter the designated area and only resume when the area has been cleared.
- Operators shall only move equipment when aware of the location of all workers and when the travel path is clear.
- Ground Personnel shall never stand between two pieces of operating heavy equipment or other objects (e.g., steel support beams, trees, buildings, etc.).
- Ground Personnel shall never stand directly below heavy equipment located on higher ground unless it can be verified ground stability is not a factor and grade of slope is such that it would not contribute to equipment tip-over.
- Ground Personnel may only enter the swing area, work area or path of travel of any operating equipment when:
  - They have attracted the operator's attention and established eye contact, and
  - The operator has idled the equipment down, placed it in neutral, grounded engaging tools, set brakes and communicated entry is permitted.
- Employees shall keep all extremities, hair, tools, and loose clothing away from pinch points and other moving parts on heavy equipment.
- Employees shall not talk, text, or otherwise use a cell phone while standing or walking on a roadway or other heavy equipment path.

4.3.3 At a minimum, all Ground Personnel and Operators outside of heavy equipment shall wear the following:

- High visibility safety vest (fluorescent background material and retro-reflective striping) meeting jurisdictional requirements that is visible from all angles.
  - Background material: should be fluorescent yellow-green, fluorescent orange-red or fluorescent red.
  - Combined-performance retro-reflective material (e.g. the stripes): should be fluorescent yellow-green, fluorescent orange-red or fluorescent red - and shall be in contrast (that is, have a distinct color difference) to the background material.
  - Hazards may require high visibility garments that cover torso, legs and arms.
  - Confirm that vest is not faded or covered with outer garments, dirt, etc.
- American National Standards Institute/Canadian Standards Association- (ANSI/CSA-) approved hard hat
- ANSI/CSA-approved safety glasses with side shields
- At a minimum, CSA or ASTM approved, high-cut (min. 6"), puncture, impact and compression resistant footwear.
- ANSI/CSA-approved hearing protection as needed
- Appropriate work clothes (e.g., full-length jeans/trousers and a sleeved shirt; no tank, crew tops or other loose clothing permitted).

4.4 Prior to work commencing

4.4.1 All heavy equipment will be inspected pre-shift and then regularly as required with the details of the inspection recorded in a log book.

- Roll-over protection systems (ROPS) and appropriate overhead protection (Fall Object Protection FOP) shall be in place given the specific equipment requirements. Utilize equipment with enclosed cabs where feasible or accessible.
    - Where use of equipment with enclosed cabs is not feasible or said equipment is not accessible, operators shall use any additional personal protective equipment determined as necessary (e.g. goggles, additional hearing protection, etc.).
- Equipment operated in hazardous atmosphere environments shall be equipped with the proper safety equipment (e.g., spark arrestors, positive air shut off, etc.).
- Operation of equipment that has or had cab glass (per the manufacturer's specifications) that is cracked/broken (obstructing the operator's view) or missing is prohibited.
- A locking device shall be provided that will prevent the accidental separation of towed and towing vehicles on every fifth-wheel mechanism and two-bar arrangement.
- Trip handles for tailgates of dump trucks and heavy equipment shall be arranged so that when dumping, the operator will be in the clear.
- The Operator will report defects and conditions affecting the safe operation of the equipment to the Site Supervisor or employer. Any repair or adjustment necessary for the safe operation of the equipment will be made before the equipment is used.
- Exposed moving parts on heavy equipment (belts, gears, shafts, pulleys, sprockets, spindles, drums, fan belts, flywheels, chains, or other reciprocating, rotating or moving parts) which are a hazard to the operator or to other workers will be guarded.
    - If a part will be exposed for proper function it will be guarded as much as is practicable consistent with the intended function of the component.

4.4.2 An approved 4A40BC fire extinguisher shall be present on all heavy equipment. An approved 4A40BC fire extinguisher of appropriate rating shall be present and readily accessible on all heavy equipment.

- Fire extinguishers shall be inspected by the operator prior to heavy equipment operation each shift. Monthly and annual inspections shall be documented.

4.4.3 All Operators shall inspect the area adjacent to the machine prior to starting.

- Evaluate ground conditions, concurrent operations and obstructions to identify approved routes of travel and work areas.
- As applicable, check that there is sufficient swing room and that the outriggers are adequately supported on solid and stable ground

4.4.4 Managers / Supervisors shall inform the operators of the equipment that AECOM employees are in the area and inquire if there are any restricted areas or specific rules or requirements. In some industrial facilities, heavy equipment has the 'right of way'.

4.4.5 Where the Operator will not have a full view of the path of travel, a signal person will be used on the ground that has a full view of the load, the operator, and the path.

4.4.6 All heavy equipment with limited visibility (operator cannot directly or by mirror or other effective device see immediately behind the machine) operated around workers or on a construction site:

- Shall have an audible back-up alarm installed that functions automatically when the vehicle or equipment is put into rear motion.

- All bi-directional equipment shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction.
- Backing up or movement in both directions for bidirectional equipment shall occur only when a signal person communicates that it is safe to do so if alarms or horns are not feasible.

4.5 Operation

4.5.1 The Operator of heavy equipment is the only worker permitted to ride the equipment unless the equipment is equipped by the manufacturer for passengers. Manufacturer operator's manual shall be complied with.

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

- Oilers, apprentices, and other operators will not be allowed to operate equipment unless authorized by the Manager.

4.5.3 The Operator of heavy equipment will operate the equipment safely, maintain full control of the equipment, and comply with the manufacturer's operator manual and the laws governing the operation of the equipment.

- Operation of company-owned, leased, or rented vehicles or equipment while under the influence of alcohol or illegal drugs or otherwise impaired is prohibited.
- Do not operate any equipment beyond its safe load or operational limits.
- Operator shall not talk on, text, or otherwise use mobile phones while operating heavy equipment.
- Never use bucket teeth or boom for lifting or moving heavy objects.

4.5.4 When heavy equipment is used for lifting or hoisting or similar operations there shall be a permanently affixed notation stating the safe working load capacity of the equipment and the notation shall be kept legible and clearly visible to the operator.

4.5.5 A Supervisor or Manager will not knowingly operate or permit a worker to operate heavy equipment which is, or could create, an undue hazard to the health or safety of any person. Where compliance is refused, the Manager or his or her designate should be notified immediately.

4.5.6 The Operator of heavy equipment will not leave the controls unattended unless the equipment has been secured against inadvertent movement.

- The Operator is not to leave suspended load, machine or part or extension unattended, unless it has been immobilized and secured against inadvertent movement.
- Turn off heavy equipment, place gear in neutral and set parking brake prior to leaving vehicle unattended.
- Buckets and blades are to be placed on the ground and with hydraulic gears in neutral when not in use.
- Brakes shall be set and, as necessary, wheels chocked or equivalent (as applicable) when not in use.

4.5.7 The Operator will maintain the cab, floor and deck of heavy equipment free of material, tools or other objects which could create a tripping hazard, interfere with the operation of controls, or be a hazard to the operator or other occupants in the event of an accident.

4.5.8 If heavy equipment has seat belts required by law or manufacturer's specifications, the Operator and passengers will use the belts whenever the equipment is in motion, or engaged in an operation which could cause the equipment to become unstable.

- Seat belts shall be maintained in functional condition, and replaced when necessary to ensure proper performance.

4.5.9 All vehicles transporting material or equipment on public roads shall comply with local laws pertaining to weight, height, length, and width. Obtain any permits required for these loads.

4.5.10 Never jump on to or off of a piece of heavy equipment, always maintain 3-points of contact at a minimum.

4.5.11 Never exit heavy equipment while it is in motion.

4.5.12 Do not ride with arms or legs outside of the truck body of equipment cab.

- Never ride on the outside of a piece of heavy equipment (e.g. in a standing position on the body, on running boards, or seated on side fenders, cabs, cab shields, rear of truck bed, on the load, bucket, etc.).

4.5.13 Have vehicle headlights on at all times when driving in the area.

4.5.14 Park motor vehicles off the haul roads, or away from the work areas.

4.5.15 Do not wear loose clothing or jewelry where there is a danger of entanglement in rotating equipment.

4.5.16 Do not enter the swing area of machines such as cranes, heavy drill rigs, or excavators, without first making eye contact with the operator, and receiving permission to do so. Refer to *S3AM-309-ATT2 Operator Line of Sight.*

4.5.17 Stay out of the blind areas around heavy equipment and never assume that the equipment operators have seen you or are aware of your presence.

4.5.18 Maintain a distance of at least 2 feet (60 centimeters) between the counterweight of swing machines and the nearest obstacle. If this distance cannot be maintained, a spotter shall observe and be in constant communication with the operator to prevent contact.

4.5.19 Vibrations from moving traffic or heavy equipment can cause excavations or spoil piles to become unstable.

- Excavation activity shall be conducted according to *SOP S3AM-303-PR1 Excavation*.
- Equipment not involved in the excavating activity or not required to be in the vicinity shall keep clear. Equipment that shall operate in the vicinity shall maintain appropriate setback distances from edges of excavations or spoil piles.

4.5.20 All heavy equipment shall be operated in a safe manner that will not endanger persons or property.

- When ascending or descending grades in excess of 5 percent, loaded equipment shall be driven with the load upgrade.
- When operating an electric-powered, remote controlled, hydraulic device used for demolishing concrete structures and refractory linings as well as excavating, refer to the *S3AM-309-ATT1 Brokk 180* for more specifics.

4.5.21 All heavy equipment shall be operated at safe speeds. Do not drive any vehicle at a speed greater than is reasonable and safe for weather conditions, traffic, intersections, width, and character of the roadway, type of motor vehicles, and any other existing condition.

4.5.22 Always move heavy equipment up and down the face of a slope. Never move equipment across the face of a slope.

4.5.23 Slow down and stay as far away as possible while operating near steep slopes, shoulders, ditches, cuts, or excavations.

4.5.24 When feasible, Operators shall travel with the “load trailing”, if the load obstructs the forward view of the operator.

4.5.25 Slow down and sound horn when approaching a blind curve or intersection. Signal people equipped with 2-way radio communications may be required to adequately control traffic.

4.5.26 All haulage equipment / trucks, whose payload is loaded by means of cranes, power shovels, loaders, or similar equipment, shall have a cable shield and/or canopy adequate to protect the operator from shifting or falling material. If protection is not available for the operator, the operator shall leave the vehicle and wait in a designated safe location until it is loaded..

4.5.27 Equipment shall be shut down prior to and during fueling.

- Confirm proper grounding/ bonding between equipment and fuel vehicle prior to fueling operations.
- During fuel operations confirm fuel nozzle remains in contact with the tank.
- Do not smoke, use electrical devices or have an open flame present while fueling.
- Fuel shall not be carried in or on heavy equipment, except in permanent fuel tanks or approved safety cans.

4.5.28 Site vehicles will be parked in a designated parking location away from heavy equipment.

4.5.29 Operators shall never push/pull “stuck” or “broken-down” equipment unless a spotter determines that the area is cleared of all personnel around and underneath the equipment.

4.5.30 If designated for work in contaminated areas/zones, equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas.

4.5.31 Equipment left unattended at night adjacent to travelled roadways shall have appropriate lights or reflectors, or barricades equipped with appropriate lights or reflectors, to identify the location of that equipment, and shall not be closer than 6 feet (1.8m) (or the regulatory requirement for the work location) to the active roadway.

4.5.32 Rubber / pneumatic-tired earthmoving haulage equipment shall be equipped with fenders on all wheels. Mud flaps may be used in lieu of fenders whenever motor vehicle equipment is not designed for fenders.

4.5.33 Lift trucks shall have the rated capacity clearly posted on the vehicle, and the ratings are not to be exceeded.

4.5.34 Steering or spinner knobs shall not be attached to steering wheels.

4.5.35 High-lift rider industrial trucks shall be equipped with overhead guards.

4.5.36 All hot surfaces of equipment, including exhaust pipes or other lines, that present a possible injury or fire hazard, shall be guarded or insulated.

4.5.37 All equipment having a charging skip shall be provided with guards on both sides and open end of the skip area to prevent persons from walking under the skip while it is elevated.

4.5.38 Platforms, foot walks, steps, handholds, guardrails, and toeboards shall be designed, constructed, and installed on machinery and equipment to provide safe footing and access ways.

4.5.39 Substantial overhead protection shall be provided for the operators of fork lifts and similar equipment.

4.5.40 In an effort to reduce air emissions, fuel costs, and run-time hours (that can impact equipment warranty), operators shall limit heavy equipment engine idling to not more than five consecutive minutes. Local regulations at the location of the vehicle operation could require less than five consecutive minutes idling time. The idling limit does not apply to:

- Idling when queuing.
- Idling to verify that the vehicle is in safe operating condition.

- Idling for testing, servicing, repairing or diagnostic purposes.
- Idling necessary to accomplish work for which the vehicle was designed (cranes, man-lifts, forklifts, etc.)
- Idling required to bring equipment/vehicle to operating temperature, as specified by the manufacturer. Engine heaters shall be used for cold weather starting to avoid engine idling where feasible.
- Idling necessary to ensure safe operation of the vehicle.
- Idling to keep equipment (including windows) clear of ice and snow.
- Idling to provide air conditioning or heat to ensure the health and safety of the operator, but only when seated inside the equipment or vehicle.

4.6 Utilities

4.6.1 When contacted by heavy equipment, aboveground and underground utilities may cause severe injuries or death as a result of electrocution, explosion, etc. Refer to the *S3AM-322-PR1 Overhead Lines* procedure for more specifics.

4.6.2 The following outline the requirements while performing heavy equipment operations that may lead to contact with aboveground or underground utilities:

- Always be aware of surrounding utilities.
- Confirm all equipment (e.g., dump trailers, loaders, excavators, etc.) is lowered prior to moving underneath aboveground utilities.
- Confirm utilities are cleared and identified prior to beginning any earthmoving operation. Contact the local utility service providers for clearance prior to performing work. Confirm documentation of the contact is made; date, number; contact name, organization, etc. Refer to *SOP S3AM-303-PR1 Excavation* and *S3AM-331-PR1 Underground Utilities & Subsurface Installation Clearance.*

4.7 Training

4.7.1 The Operator or other qualified supervisor will provide all on-site personnel with an orientation to the heavy equipment and its associated hazards and controls.

4.7.2 Only designated, qualified personnel shall operate heavy equipment.

4.7.3 Operators shall have all appropriate jurisdictional licenses or training to operate a designated piece of heavy equipment.

4.7.4 Operators shall be evaluated through documented experience and routine monitoring of activities unless the equipment is operated by an AECOM operator in which case a practical evaluation is required. Operators shall be knowledgeable and competent in the operation of a designated piece of heavy equipment.

4.8 Inspection and Maintenance

4.8.1 Maintenance records for any service, repair or modification which affects the safe performance of the equipment will be maintained and be reasonably available to the operator and maintenance personnel regulatory agencies upon request during work hours.

4.8.2 Maintenance records will be maintained on the site or project for heavy equipment.

4.8.3 Conduct maintenance as prescribed by the manufacturer in the Operation Manual for each piece of equipment.

4.8.4 Servicing, maintenance and repair of heavy equipment will not be done when the equipment is operating.

- Lockout and tagout safety procedures are followed. Refer to *S3AM-325-PR1 Lockout Tagout*.

- Motors are turned off, unless required for performing maintenance or repair.
- All ground-engaging tools are grounded or securely blocked.
- Controls are set in a neutral position and brakes are set.
- Electrically driven equipment is installed with provision for tagging and locking out the controls while under repair.
- Manufacturer's requirements for maintenance and repair are followed.
- If continued operation is essential to the process, a safe means of protection shall be provided.
- Provide and use a safety tire rack, cage, or equivalent protection when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices.

4.8.5 All heavy equipment shall have a documented inspection and if necessary, repaired prior to use.

- Operators shall not operate heavy equipment that has not been cleared for use.
- All machinery and mechanized equipment will be verified to be in safe operating condition (refer to *S3AM-309-FM1 Approval of Machinery & Mechanized Equipment*) by a competent person (refer to *S3AM-202-PR1 Competent Person Designation*) within seven days prior to operation on a new site or project. Clearance is valid for up to one year for the given site or project.
- As applicable, all machinery and mechanized equipment shall be inspected / certified and tested at appropriate intervals as required by the manufacturer and/or regulatory requirements.

4.8.6 All heavy equipment shall be inspected at a minimum to the manufacturer's recommendations prior to each work shift. All defects shall be reported to the Supervisor/ Manager immediately.

- Defective heavy equipment shall be immediately tagged and taken out of service until repaired.
- Inspection, maintenance, service and repair records shall be maintained at the site. If a manufacturer's or company-specific inspection checklist is not provided, use *S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist*.
- Records shall be made available for review upon request. Note: Documents may be electronically stored in the project files.

4.9 Fueling and batteries

4.9.1 A well-ventilated area shall be used for refueling.

4.9.2 Only the type and quality of fuel recommended by the engine manufacturer shall be used.

4.9.3 Fuel tanks shall not be filled while the engine is running. All electrical switches shall be turned off.

4.9.4 If there is potential to spill fuel on hot surfaces, the surfaces shall be permitted to cool down prior to fueling. Any spillage shall be cleaned before starting engine.

4.9.5 Spilled fuel shall be cleaned with cotton rags or cloths and disposed of in the proper receptacle; do not use wool or metallic cloth.

4.9.6 Open flames, lighted smoking materials, sparking equipment or any other type of ignition source shall remain a minimum of 35' (10.7m) from the fueling area and/or fuel source. This clearance shall be increased if required or conditions warrant.

4.9.7 Heaters in carrier cabs shall be turned off when refueling the carrier or the drill rig.

4.9.8 Portable containers to be filled shall be placed directly on the ground or be properly grounded prior to filling to prevent creation of a static charge. Portable fuel containers shall not be filled completely to allow expansion of the fuel during temperature changes.

4.9.9 Control electrostatic hazards.

- Before activating fuel pump, touch some part of vehicle / equipment to de-energize any static electricity that may be present.
- The fuel nozzle shall be kept in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Fuel containers and transfer hoses shall be kept in contact with a metal surface during travel to prevent build-up of a static charge.

4.9.10 Portable fuel containers shall not travel in the vehicle or carrier cab with personnel.

4.9.11 Batteries shall be serviced in a ventilated area while wearing appropriate Personal Protective Equipment.

4.9.12 When a battery is removed from a vehicle or service unit, the battery shall be disconnected ground post first. Consult the SDS applicable to the battery and/or contents for additional information including; handling, precautions, and first aid measures.

- Spilled battery acid shall be immediately flushed off the skin with a continuous supply of water. Battery storage or maintenance areas shall have readily accessible eye wash stations.
- Should battery acid get into the eyes, the eyes shall be flushed immediately with copious amounts of water and medical attention shall be sought immediately.

4.9.13 When installing a battery, the battery shall be connected ground post last.

4.9.14 When charging a battery, cell caps shall be loosened prior to charging to permit gas to escape.

4.9.15 When charging a battery, the power source shall be turned off to the battery before either connecting or disconnecting charger loads to the battery posts.

4.9.16 To avoid battery explosions, the cells shall be filled with electrolytes. A flashlight (not an open flame) shall be used to check water electrolyte levels. Avoid creating sparks around batteries by shorting across a battery terminal. Lighted smoking materials and flames shall be kept at least a minimum of 35 feet (10.7 meters) away from battery-charging stations.

5.0 Records

5.1 Inspection, maintenance, service and repair records shall be maintained with the equipment.

6.0 Attachments

6.1 S3AM-309-ATT1 Brokk180 Safety Card

6.2 S3AM-309-ATT2 Operator Line of Sight

6.3 S3AM-309-FM1 Approval of Machinery & Mechanized Equipment

6.4 S3AM-309-FM2 Heavy Machinery Pre-Operation Checklist

6.5 S3AM-309-FM3 Rubber Tire Backhoe Operator Skill Evaluation

6.6 S3AM-309-FM4 Scraper Operator Skill Evaluation

6.7 S3AM-309-FM5 Bull Dozer Operator Skill Evaluation

6.8 S3AM-309-FM6 Dump Truck Operator Skill Evaluation

6.9 S3AM-309-FM7 Roller Compactor Operator Skill Evaluation

6.10 S3AM-309-FM8 Front End Loader Operator Skill Evaluation

6.11 S3AM-309-FM9 Grader Operator Skill Evaluation

6.12 S3AM-309-FM 10 Excavator Operator Skill Evaluation

6.13 S3AM-309-FM11 Water Truck Operator Skill Evaluation

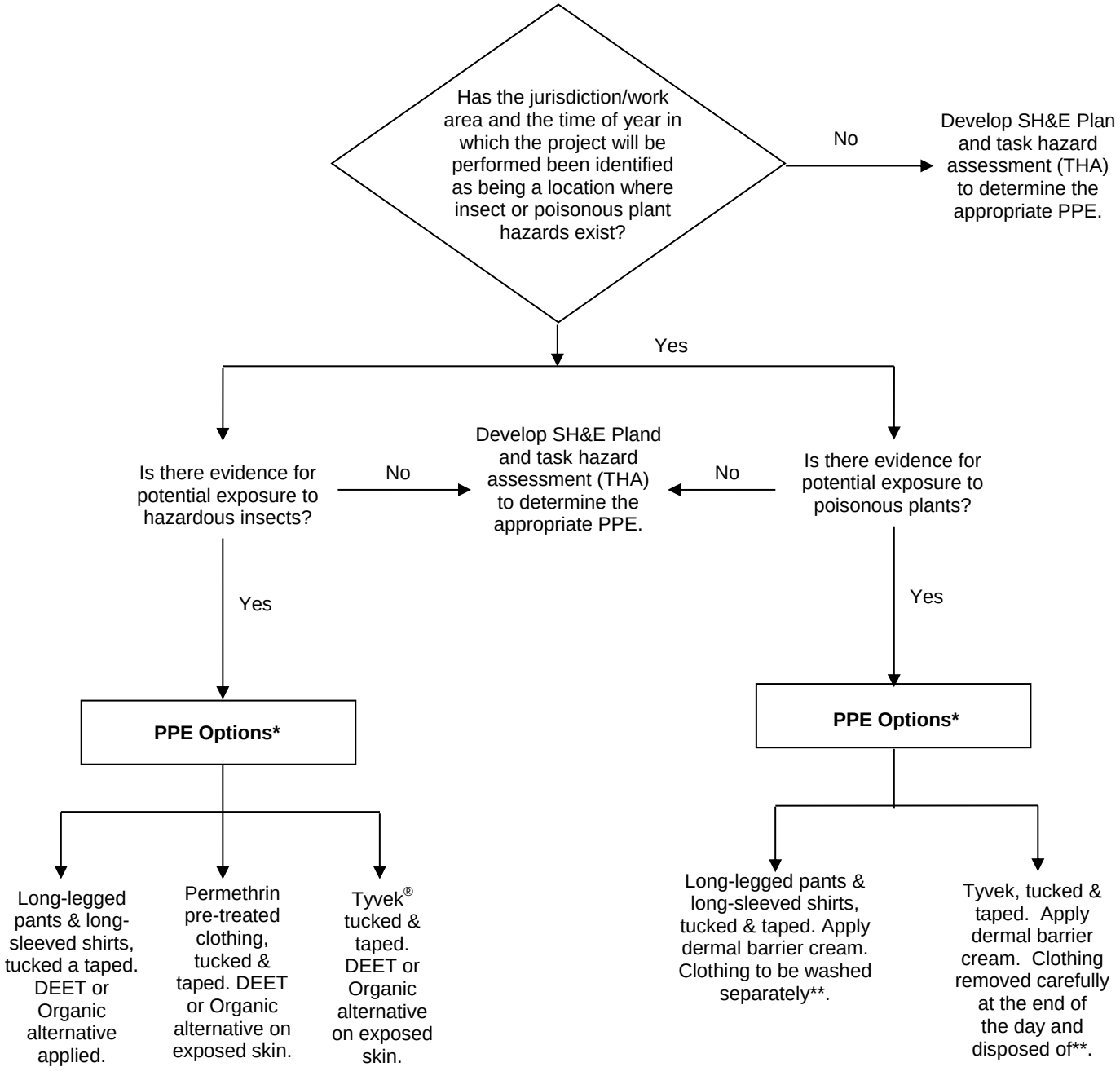
6.14 S3AM-309-FM12 Heavy Equipment Maintenance Inventory

6.15 S3AM-309-FM13 Heavy Equipment Inspection Report

Americas

Biological Hazard Assessment Decision Flowchart

S3AM-313-ATT1



* indicates that when both insect and poisonous plant hazards are recognized hazards at a project site, the most conservative combination of the available PPE choices will be selected. Include the selected PPE option in the respective SH&E Plan and THA.

** indicates that clothing that has been known or suspected to have come in contact with poisonous plants must be washed before it can be worn again. Similarly, Tyvek® that has been known or suspected to have come in contact with poisonous plants will be disposed of rather than reused during a subsequent day or project.

Americas

Ticks

S3AM-313-ATT2

1.0 Background

1.1 The Public Health Agency of Canada and the Centers for Disease Control and Prevention work with States and Provinces, health authorities and other experts on research to define and monitor the occurrence of the ticks that carry bacterium that cause disease, including but not limited to:

1.1.1 *Borrelia burgdorferi*, the bacterium that causes Lyme disease.

- In the United States and Canada, the black-legged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western black-legged tick (*Ixodes pacificus*) are the species known to transmit this disease-causing agent, as well as other less common agents.

1.1.2 *Rickettsia rickettsia,* the bacterium that causes Rocky Mountain Spotted Fever.

- In the United States and Canada, the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and brown dog tick (*Rhipicephalus sanguineus)* are known to transmit this disease-causing agent.

1.1.3 *Francisella tularensis*, the bacterium that causes Tularemia.

- In the United States, these include the American dog tick (*Dermacentor variabilis*), Rocky Mountain wood tick (*Dermacentor andersoni*), and Lone star tick (*Amblyomma americanum*).

1.1.4 *Ehrlichiosis*, the general name to describe several bacterial diseases that affect animals and humas.

- In the United States, these include the black-legged tick (*Ixodes scapularis*; often referred to as a deer tick) and the western black-legged tick (*Ixodes pacificus*), and Lone star tick (*Amblyomma americanum*).

1.2 Consult local health authorities to determine where tick populations are established or emerging. Locations where distribution may have previously been limited may show evidence of larger populations. Employees working in or adjacent to areas where there are established tick populations may have a greater chance of contact with ticks.

1.3 While there is a higher risk of coming in contact with infected ticks in areas where populations are established, there is also a low risk of tick-borne diseases being contracted almost anywhere in the Americas as migratory birds transport infected ticks over large geographic distances. Take precautions to reduce tick contact.

1.4 Lyme Disease

1.4.1 The rate of infection of ticks with the bacterium that causes Lyme disease varies. Infection rates are typically higher in adult ticks compared to the other stages (nymphs and larvae).

1.4.2 Despite the lower rates of infection, people are most likely to acquire Lyme disease from a nymph because this stage is so small and thus more likely to go unnoticed and feed for a sufficient amount of time for the Lyme disease bacterium to be transmitted (24-36 hours).

1.4.3 Infection rates are often greater in tick populations that have been established for long periods of time compared to newly established ones.

1.4.4 Lyme disease patients are most likely to have illness onset in April through November with onset peaking in June, July, or August and less likely to have illness onset from December through March

2.0 To Remove Attached Ticks

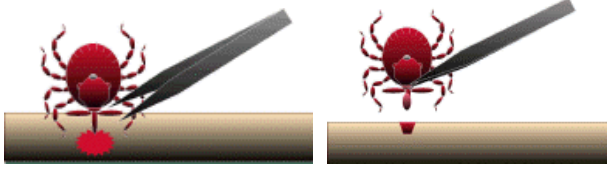
2.1 Use fine-tipped tweezers or notched tick extractor, and protect your fingers with a tissue, paper towel, or latex gloves (see figure). Persons should avoid removing ticks with bare hands.

2.2 Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. (If this happens, remove mouthparts with tweezers. Consult your health care provider if illness occurs.)

2.3 After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

2.4 Do not squeeze, crush, or puncture the body of the tick because its fluids may contain infectious organisms. Skin accidentally exposed to tick fluids can be disinfected with iodine scrub, rubbing alcohol, or water containing detergents.

2.5 Save the tick for identification in case you become ill. This may help your doctor make an accurate diagnosis of potential diseases by determining what type of tick it is. Place the tick in a sealable plastic bag and put it in your freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.



3.0 Folklore Remedies Don't Work

3.1 Folklore remedies, such as the use of petroleum jelly or hot matches, do little to encourage a tick to detach from skin. In fact, they may make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided.

4.0 Configuration of Clothing

4.1 Loose-cuff trousers must be tucked into socks, wrapped with duct tape (or equivalent) completely around the cuff of the sock up on to the surface of the pant leg to prevent entry of insects between the sock and pants, and preferably reverse-wrapped with “sticky” side out (see figure below).

Americas

Mosquito-Borne Diseases

S3AM-313-ATT4

1.0 Background

1.1 Employees working outdoors in the Americas may be exposed to mosquitoes that may transmit illnesses, including Encephalitis and Dengue.

1.2 Dengue is transmitted by the bite of a mosquito infected with one of the four dengue virus serotypes. Dengue is endemic to South America**.**

1.2.1 Dengue is a febrile illness that affects infants, young children and adults with symptoms appearing 3-14 days after the infective bite.

1.2.2 Symptoms range from mild fever, to incapacitating high fever, with severe headache, pain behind the eyes, muscle and joint pain, and rash.

1.2.3 Severe dengue (also known as dengue hemorrhagic fever) is characterized by fever, abdominal pain, persistent vomiting, bleeding and breathing difficulty and is potentially fatal.

1.3 West Nile encephalitis is an infection of the brain that is caused by a virus known as the West Nile virus.

1.3.1 Most individuals infected with WNV remain asymptomatic. West Nile (WN) fever is typically a mild illness lasting 3 to 6 days.

1.3.2 The main symptoms are sudden onset of fever with chills, rash, malaise, headache, backache, arthralgia, myalgia and eye pain. Other non-specific symptoms may include nausea, vomiting, anorexia, diarrhoea, rhinorrhoea, sore throat, and cough.

1.3.3 The main route of infection is via the bite of a mosquito that has been infected by feeding on West Nile Virus infected birds.

1.4 Arboviral encephalitis is a virus that exists in various forms in global distribution. Numerous forms occur in the Americas, including the following four primary forms that can be transmitted by mosquitoes:

1.4.1 Eastern equine encephalitis (EEE) – United States and Canada

1.4.2 Western equine encephalitis (WEE) – United States

1.4.3 St. Louis encephalitis (SLE) – United States and Canada

1.4.4 La Crosse (LAC) encephalitis.all of which are transmitted by mosquitoes – United States

1.5 Mosquitoes are known to breed in standing water; therefore, when standing water is found at a job site, actions should be taken to drain the water. Typically, mosquitoes will fly only a quarter of a mile (400 meters) from their breeding location.

1.6 The local Public Health Department and Center for Disease Control and Prevention (CDC) should be consulted to determine what diseases transmitted by mosquitoes are present and exposure prevention recommendations.

Americas

Bird Droppings Safe Work Practices

S3AM-313-ATT8

1.0 Background

1.1 According to the National Institute for Occupational Safety and Health (NIOSH), histoplasmosis is an infectious disease caused by inhaling spores of a fungus called *Histoplasma capsulatum (*abbreviated *H. capsulatum)* that may inhabit accumulated masses of pigeon droppings and excrement of other birds and flying animals. Its symptoms vary greatly, but the disease primarily affects the lungs. Occasionally, other organs are affected. This form of the disease is called disseminated histoplasmosis, and it can be fatal if untreated. The acute respiratory disease form of histoplasmosisis is characterized by respiratory symptoms, a general ill feeling, fever, chest pains, and a dry or non-productive cough. Distinct patterns may be seen on a chest x-ray. Chronic lung disease resembles tuberculosis and can worsen over months or years. If symptoms occur, they may start within 3 to 17 days of exposure, with an average of 10 days. On a positive note, histoplasmosis is not contagious.

1.2 Psittacosis, although primarily a respiratory disease, can cause a wide variety of clinical manifestations. Generally, about 10 days after infection occurs, the clinical illness begins abruptly with fever, chills, weakness, fatigue, muscle pain, anorexia, nausea, vomiting, excessive sweating and difficulty with breathing, headache, backache, and sensitivity to light.

1.3 Hypersensitivity pneumonitis is also known as pigeon breeder's disease.

2.0 Symptoms

2.1 The acute form of hypersensitivity pneumonitis is clinically characterized by chills, fever, cough, breathlessness without wheezing, and malaise 4-10 hours after exposure. In general, an acute attack subsides after 18 to 24 hours.

3.0 Treatment

3.1 If a person should develop any of the symptoms as noted above, or others, it is important to see a physician and inform him of an exposure to pigeon/bird or bat excrement. A failure to diagnose the preceding conditions could occur if a treating physician is unaware of a patient's exposure to pigeon/bird or bat excrement.

4.0 Prevention

4.1 Prior to work in any area where pigeons or other flying animals may nest, a written statement from the client shall be obtained in regards to the potential for, and extent of, accumulation of excrement on/in the structure from pigeons and other winged animals.

4.2 The client shall be asked to provide appropriate details as to the basis for their statement (e.g., date of last visual survey for pigeon/bird or bat excrement accumulation, date of last excrement removal effort, etc.).

4.3 In no case will an AECOM employee or contract employee be permitted to commence structure inspection procedures without the Project Manager having received and evaluated the aforementioned written statement from the client.

4.4 According to NIOSH, the best way to prevent exposure to *H. capsulatum* spores during survey and inspection work is to avoid situations where excrement and other potentially contaminated material can become airborne and inhaled. Therefore, it is preferable that the efforts to determine if, and to what extent, there is an accumulation of pigeon/bird or bat excrement on/in structures, or the efforts to clean-up/remove/dispose of such contaminated material, be left to the client or subcontracted out.

5.0 Safe Work Practices

5.1 In those cases where AECOM employees or contract employees are contracted by the client to determine the extent of accumulation of animal excrement in/on structures, the following minimum safety and health precautions shall be taken. (NOTE: precautionary measures are based on recommendations and best practices prescribed in the NIOSH 2004 public document titled *Histoplasmosis – Protecting Workers at Risk*).

5.2 All workers shall wear disposable protective clothing (Tyvek® coveralls). Disposable overalls with hoods shall be donned when working in areas where *H. capsulatum* spore-contaminated material is likely to fall from overhead.

5.3 All workers shall wear disposable shoe coverings fitted with ridged soles made of slip-resistant material to reduce the likelihood of slipping on wet or dusty surfaces. Gloves shall be worn.

5.4 All workers shall wear a full facepiece air purifying respirator fitted with P100 (HEPA) cartridges. If entering an enclosed area in which the extent of excrement contamination is unknown, additional protective measures shall be taken such that workers shall wear a powered air-purifying respirator (APR) with full facepiece fitted with P100 (HEPA) cartridges. Any variance from these requirements must be approved by the Region Safety, Health an Environment Manager. Workers donning APRs shall be medically screened, cleared, and trained in their proper use in accordance with AECOM safety program standards.

5.5 If contaminated material must be disturbed for purposes of removal/disposal or during the structure inspect process, it shall be wetted down prior to all work and will be rewetted as necessary to minimize airborne dusting.

5.6 After working in *H. capsulatum* spore-contaminated areas and before removing any respiratory protective equipment, workers shall remove all protective clothing and shoe coverings and seal them in a heavy-duty plastic bag for disposal.

5.7 Workers shall observe a high degree of personal hygiene, even if the exposure is casual. Special care shall be taken to wash hands, face, and other areas of exposed skin thoroughly before eating, drinking or smoking.

Americas

Wildlife, Plants & Insects

S3AM-313-PR1

1.0 Purpose and Scope

1.1 Communicates the requirements and precautions to be taken by AECOM employees to protect against the biological hazards associated with insects, arachnids, snakes, poisonous plants, and other animals referred to herein collectively as “biological hazards”.

1.2 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document’s content.

2.0 Terms and Definitions

2.1 **Field Work –** Any activity conducted at a site that contains brush, overgrown grass, leaf litter, poisonous plants, or is located near mosquito breeding areas and includes work in structures where animals might exist that harbor fleas or ticks or where spiders and mites could be present. Field work includes, but is not limited to, Phase I, Phase II, Operations Monitoring & Maintenance, biological surveys, and other work that meets the definition of field work.

2.2 **Poisonous** – Capable of harming or killing by or as if by poison; toxic or venomous.

2.3 **Phase I Environmental Site Assessment –** Investigation of real property to determine the possibility of contamination, based on visual observation and property history, but no physical testing. Under new Environmental Protection Agency regulations that went into effect on November 1, 2006, a Phase I, as it is called for short, will be mandatory for all investors who wish to take advantage of Comprehensive Environmental Response, Compensation, and Liability Act defenses that will shield them from liability for future cleanup, should that prove necessary. The new Phase I rules, called “All Appropriate Inquiry” or AAI, also require more investigation than previously mandated. Investors can expect to see dramatic price increases over prior experiences.

2.4 **Phase II Environmental Site Assessment** – Investigation of real property through physical samplings and analyses to determine the nature and extent of contamination and, if indicated, a description of the recommended remediation method.

3.0 References

3.1 RS2-001-PR1 Firearms Standard

3.2 S3AM-004-PR1 Incident Reporting, Notifications & Investigation

3.3 S3AM-008-PR1 Fitness for Duty

3.4 S3AM-113-PR1 Heat Stress

3.5 S3AM-208-PR1 Personal Protective Equipment

3.6 S3AM-209-PR1 Risk Assessment & Management

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Managers / Supervisors**

- Responsible for managing field work.

- Work with employees to see that a Task Hazard Analysis (THA) for the work to be conducted has been performed prior to the beginning of the field work and that it includes an assessment of potential biological hazards.
- Implement control measures at the location to reduce the potential for employees to be exposed to injuries and illnesses from biological hazards while working.
- If the exposures cannot be eliminated or managed with engineering controls, approve the use and cost of Personal Protective Equipment (PPE) and protective repellents and lotions and confirm that exposed employees have and use these products.

4.1.2 **SH&E Manager**

- Confirm training and guidance is provided to employees consistent with this procedure.
- During the performance of site visits, assess the precautions being taken against biological hazards for compliance with this procedure.
- Assist AECOM personnel in identifying hazards and selecting appropriate control measures.
- As applicable, review and approve relevant SH&E Plans for locations that have biological hazards.

4.1.3 **Employees**

- Participate in required training related this procedure.
- Participate in the development of THAs for the task, identify control measures to limit exposure and request PPE, repellents, and protective lotions identified by this procedure.
- Update the applicable THA when a new, unaccounted for biological hazard is identified. Employee shall stop work to identify appropriate elimination or control measures (and obtain any necessary guidance) before continuing work.
- Obtain approval from Managers and/or Supervisors to purchase selected PPE prior to purchasing.
- Implement the precautions appropriate to prevent exposure to the hazardous wildlife, insects and plants.
- Observe requirements for reporting (e.g. tick bites, skin irritations, etc.) as detailed within the procedure and attachments.

4.2 Training

4.2.1 Employees shall be trained to recognize organisms that represent a threat in the regions in which they work – experienced field staff shall provide on the job training to assist staff with hazard recognition.

4.2.2 Employees shall be properly trained to the anticipated tasks and the associated required PPE.

4.3 Overview

4.3.1 The procedures discussed below are detailed because these hazards have historically posed the most significant risk to AECOM employees. Note that this discussion is not a fully encompassing list of hazards. As part of the SH&E Plan and THA developed by the AECOM personnel, in accordance with *S3AM-209-PR1 Risk Assessment & Management*, additional consideration shall be given to other biological hazards.

4.3.2 Departments of Public Health local to the worksite, as well as the Centers for Disease Control (CDC) can serve as a resource for identifying biological hazards not discussed in this procedure.

4.3.3 If additional biological hazards are identified, employees should stop work and contact the SH&E Manager to discuss the hazards and identify effective control measures. Those control measures shall be implemented at the location prior to restarting work.

4.4 Employee Sensitivity

4.4.1 Sensitivity to toxins generated by plants, insects and animals varies according to dosage and the ability of the victim to process the toxin; therefore, it is difficult to predict whether a reaction will occur, or how severe the reaction will be. Employees should be aware that there are a large number of organisms capable of causing serious irritations and allergic reactions. Some reactions will only erupt if a secondary exposure to sunlight occurs. Depending on the severity of the reaction, the result can be severe scarring, blindness or even death.

4.4.2 Employees also need to consider whether they are sensitive to the use of insect repellents.

4.5 Planning and Hazard Assessment

4.5.1 AECOM personnel shall confirm that the potential for exposure to specific biological hazards are assessed prior to the commencement of work and that the procedures specified by this procedure are integrated into the THA planning process and conveyed to employees conducting the field work. This information shall be communicated in the location-specific SH&E plan, the THA, pre-project kickoff meetings, and tailgate meetings at the location.

4.5.2 It is important to note that the precautions to be taken by employees to decrease the risk of exposure to biological hazards can directly increase the risk of heat-related illness due to thermal stresses. Therefore, heat stress monitoring and precautions shall be included as a critical component of the task-specific THA in accordance with *S3AM-511-PR1 Heat Stress.*

4.5.3 During the preparation of the location-specific SH&E plan and task specific THA, Managers, Supervisors, and employees shall determine what biological hazards might be encountered during the task or operations and shall prescribe the precautions to be taken to reduce the potential for exposure and the severity of resulting illnesses. Consideration will be given to conditions such as weather, proximity to breeding areas, host animals, and published information discussing the presence of the hazards.

4.5.4 It should be assumed that at least one of the biological hazards exists whenever working on undeveloped property. This can include insect activity any time that local temperatures exceed 40 degrees Fahrenheit (4.5 degrees Celsius) for a period of more than 24 hours. The stubble and roots of poisonous plants can be a hazard any time of year, including when some plants are dormant or mown.

4.5.5 The hazard assessments shall also consider the additional hazards posed by vegetative clearing such as the increased risk of coming in contact with poison ivy, oak or sumac and hazards associated with the use of tools and equipment to remove vegetation.

4.5.6 Employees in the field where biological hazards exist shall not enter the hazard areas unless they are wearing the appropriate protective clothing, repellents, and barrier creams specified below. If the hazard is recognized in the field but was not adequately assessed during the THA, the field staff shall stop work and not proceed until the THA has been amended and approved and protective measures implemented.

4.5.7 Employees who have severe allergic reactions are strongly recommended to notify their Manager, field Supervisor and co-workers of the potential for a reaction and demonstrate what medication they might need, where they keep it and how it is administered.

4.5.8 A decision flow chart and table for determining the potential for biological hazards in the Americas has been provided in *S3AM-313-ATT1 Biological Hazard Assessment Flow Chart.*

4.5.9 Restrictions:

- No firearms or weapons are allowed to be used without express permission by the Region Executive and Chief Resilience Officer, refer to the *RS2-001-PR1 Firearms Standard*.
- No weapons related work shall occur without an assessment that includes appropriate hazard control measures and training.

- Staff with life-threatening reactions shall not undertake work in areas infested with the allergen (e.g., wasps, poison ivy), unless precautions are met which satisfy a medical practitioner's requirements. Refer to *S3AM-008-PR1 Fitness for Duty*.

4.5.10 Precautions

- Be aware of the potential irritants in your area and know how to recognize them.
- Modify activities to avoid encounters (diurnal rhythms, seasonal rhythms).
- Avoid wearing perfume and cologne and strong smelling deodorants, lotions, soaps, and shampoos.
- When working in areas where there may be small insects that "hitchhike" (e.g., ticks, spiders, scorpions), it is recommended that clothes are turned inside out and shaken at the end of day; do not wear same clothes two days in a row.
- Staff should always be aware of where they are placing their hands, or where they are sitting in order to avoid contact with potential toxins. Avoid reaching into areas where visibility is limited.

4.6 Wildlife Hazards (Wild Animals, Reptiles and Birds)

4.6.1 Employees shall not work alone in areas where the risk of an encounter with dangerous wildlife is high. Wildlife handling shall only be completed under direct supervision of an experienced individual. Refer to the following work instructions for more specifics:

- *S3AM-313-ATT13 Alligators*
- *S3AM-313-ATT9 Large Carnivores & Ungulates*
- *S3AM-313-ATT10 Bear Safety*
- *S3AM-313-ATT11 Small Mammals*
- *S3AM-313-ATT12 Snakes & Scorpions*

4.7 Ticks, Spiders and other Insects

4.7.1 Insects for which precautionary measures should be taken include but are not limited to: mosquitoes (potential carriers of disease aside from dermatitis), black flies, wasps, bees, ticks, fire ants and European fire ants.

4.7.2 Employees with known allergies to insect stings should consult their personal physician for advice on any immediate medications that they should carry with them. Epi-pens[1] shall be carried at all times in the field by employees who are aware that anaphylactic shock is a possibility for them AECOM highly recommends that employees with known allergies inform their co-workers of the allergy and the location of the medications they might carry for the allergy.

4.7.3 Habitat Avoidance, Elimination and/or Control

- The most effective method to manage worker safety and health is to eliminate, avoid and/or control hazards. Clearing the location of brush, high grass and foliage reduces the potential for exposure to biological hazards. Clearing will not eliminate the exposure to flying insects and there might be an increased exposure to ticks and spiders during the clearing process.
- Projects such as subsurface environmental assessment or remediation are often candidates for brush and overgrown grass to be cleared. In these instances, the Manager shall either request that the client eliminate vegetation, or request approval from the client to have vegetation clearing added to the scope of work.
    - It should be noted that vegetation clearance may unintentionally serve to spread noxious and poisonous plant materials around the site.

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[1] Epi-pens must be prescribed by a personal physician. Renew epi-pens on a regular schedule to ensure effectiveness and make sure your field companions know where it is and how to use it if you cannot self-administer the dose.

- As applicable, measures should be taken to prevent spread, such as but not limited to, confirming equipment and materials are not placed on affected areas, and equipment is decontaminated after use and before removal from site.

- When work shall be conducted in areas that cannot or may not be cleared of foliage, personal precautions and protective measures shall be prescribed.
- Mosquitoes breed in stagnant water and typically only travel a quarter mile (less than half a kilometer) from their breeding site. Whenever possible, stagnant water should be drained to eliminate breeding areas. Managers and client site managers should be contacted to determine whether water can be drained and the most appropriate method for draining containers, containment areas, and other objects of standing water.
- If water cannot be drained, products similar to Mosquito Dunks® can be placed in the water to control mosquitoes. Once wet, the Mosquito Dunks® kill the immature, aquatic stage of the mosquito. The active ingredient is a beneficial organism that is lethal to mosquito larvae, but harmless to fish, humans, and other animals. Mosquito Dunks® provide long-term protection for 30 days or more.

4.7.4 Ticks

- Ticks can be encountered when walking in tall grass or shrubs. They crawl up clothing searching for exposed skin where they will attach themselves. The most serious concern is a possibility of contracting a disease.
- Data from the CDC indicates that tick-borne diseases have become increasingly prevalent. At the same time, tick repellents have become both safe and effective so it is possible to prevent the vast majority of bites and, therefore, most related illnesses. The use of permethrin is strongly advised.
- The most common and severe tick-borne illnesses in the U.S. are Lyme disease, Ehrlichiosis, and Rocky Mountain spotted fever. A summary table listing CDC informational resources for these diseases is provided in *S3AM-313-ATT2 Ticks* along with a listing of CDC information resources and maps showing the distribution of common tick-borne diseases in the U.S.
- When working in areas where ticks may occur, it is recommended that clothes are turned inside out and shaken at the end of day; do not wear the same clothes two days in a row.
- Employees should conduct a thorough full body tick check upon exiting the field. Shower within two hours of coming indoors to help wash away loose ticks. Clothes should be laundered in hot water or tumble dry clothes in a dryer on high heat for 10 minutes to kill ticks.
- To remove ticks that are embedded in skin, utilize a tick key. Alternatively use tweezers or fingers to carefully grasp the tick as close to the skin as possible and pull slowly upward, avoiding twisting or crushing the tick. Do not try to burn or smother the tick. Cleanse the bite area with soap and water, alcohol, or household antiseptic. Note the date and location of the bite and save the tick in a secure container such as an empty pill vial or film canister. A bit of moistened paper towel placed inside the container will keep ticks from drying out. Follow AECOM incident reporting guidelines to report the tick bite within 4 hours and notify the Manager or Supervisor.
- Familiarize yourself with the characteristic bulls-eye pattern of Lyme disease infection surrounding the bite. If you notice this type of pattern or rash resulting from a tick bite, immediately report the issue to your supervisor and follow the incident reporting requirements for your business group.
- If you experience symptoms such as fever, headache, fatigue, and a skin rash, you should immediately visit a medical practitioner as Lyme disease is treated easily with antibiotics in the early stages, but can spread to the heart, joints, and nervous system if left untreated.

4.7.5 Chiggers

- Chiggers are mite larvae, approximately ½ millimeter in size, and typically invisible to the naked eye. While chiggers are not known to carry infectious diseases, their bites and resulting rashes and itching can lead to dermatitis and a secondary infection.
- Chiggers are typically active from the last hard freeze in the winter or spring to the first hard freeze. They are active all year in the Gulf Coast and tropical areas.

4.7.6 Spiders

- Spiders can be found in derelict buildings, sheltered areas, basements, storage areas, well heads and even on open ground. Spiders can be found year round in sheltered areas and are often present in well heads and valve boxes.
- Most spider bites produce wounds with localized inflammation and swelling. The Black Widow and Brown Recluse spiders in the U.S. and others outside the U.S. inject a toxin that causes extensive tissue damage and intense pain.
- Additional information on spider identification can be found in attachment *S3AM-313-ATT3 Poisonous Spider Identification*.

4.7.7 Mosquitoes

- When a mosquito bites, it injects an enzyme that breaks down blood capillaries and acts as an anticoagulant. The enzymes induce an immune response in the host that results in itching and local inflammation. The tendency to scratch the bite sites can lead to secondary infections.
- CDC data indicates that mosquito-borne illnesses, including the strains of encephalitis, are a health risk. At least one of the Encephalitis strains listed below is known to exist in every area of the U.S. and in many other countries as well:
    - Eastern Equine encephalitis
    - Western Equine encephalitis
    - West Nile Virus
    - St. Louis encephalitis
    - La Crosse encephalitis
- Mosquitoes can transmit the West Nile Virus and other forms of encephalitis after becoming infected by feeding on the blood of birds which carry the virus.
- Most people infected with the virus experience no symptoms or they have flu-like symptoms. Sometimes though, the virus can cause severe illness, resulting in hospitalization and even death, so proper precautions should be taken. Consult a medical practitioner if you suspect you have West Nile Virus. Other diseases including Dengue Fever and Malaria are spread by mosquitoes in the sub-tropic and tropical parts of the world. See *S3AM-313-ATT4 Mosquito Borne Diseases* for information on the locations where mosquito borne diseases are known to be present.

4.7.8 Bees, Wasps and Hornets

- Wasps and bees will cause a painful sting to anyone if they are harassed. They are of most concern for individuals with allergic reactions who can go into anaphylactic shock. Also, instances where an individual is exposed to multiple stings can cause a serious health concern for anyone. These insects are most likely to sting when their hive or nest is threatened.
- Bees, hornets, and wasps may be found in derelict buildings, sheltered areas, behind covers or lids and even on open ground. Other protective measures are not normally effective against aggressive, flying insects. Be aware of the potential areas for these types of insects, approach these locations cautiously. Avoid reaching into areas where visibility is limited.
- If you see a nest in the area you are working in stop work. Contact the Manager or Site Supervisor for procedures to have the nest removed.

- If stung by a wasp, bee or hornet, notify a co-worker or someone who can help should you have an allergic reaction. Stay calm and treat the area with ice or cold water. Follow AECOM incident reporting guidelines to report the sting within 4 hours and notify the Manager or Supervisor immediately. Seek medical attention if you have any reactions to the sting such as developing a rash, excessive swelling or pain at the site of the bite or sting, or any swelling or numbness beyond the site of the bite or sting.

4.7.9 Fire Ants

- The fire ant (southern and western U.S.) and the European fire ant (northeastern U.S. and eastern Canada) is often very abundant where it is established. It is very aggressive and commonly climbs up clothing and stings unprovoked when it comes into contact with skin. Painful irritations will persist for an hour or more.

4.7.10 Personal Protective Equipment (PPE)

- Chemically-treated field clothing, full-length clothing, or Tyvek® coveralls.
- Gloves shall also be worn consistent with the recommendations of the site-specific SWP and/or THA to minimize hand exposure.
- Where ticks, chiggers, and spiders are presumed to exist, the Tyvek® or chemically treated clothing will be taped to the work boots.
- See *S3AM-313-ATT2 Ticks* for configuration of clothing for protection against ticks and insects.
- Application of insect repellent to clothing and/or exposed skin. Oil of lemon eucalyptus, DEET, and Permethrin have been recommended by the CDC for effective protection against mosquitoes that may carry the West Nile virus and related diseases.
- Note that DEET will reduce the effectiveness of Fire Resistance Clothing (FRC) and should not be applied to this clothing. If working in FRC, employees can use Permethrin as it has been shown not to reduce the effectiveness of FRC. Permethrin will need to be applied to FRC well in advance of the planned work. If permethrin is unavailable employees can apply DEET to their skin and let dry prior to putting FRC on.
    - Oil of Lemon Eucalyptus is a plant-based insect repellent on the market as Repel Lemon Eucalyptus. The products have been proven to be effective against mosquitoes, deer ticks, and no-see-ums for up to six hours. Derived from Oil of Lemon Eucalyptus, this non-greasy lotion or spray has a pleasant scent and is not known to be toxic to humans. The spray or lotions will be effective for approximately two to six hours and should be reapplied every two hours to sustain protection. Lemon Eucalyptus products cannot be applied to fire retardant clothing.
    - Permethrin is an insecticide with repellent properties registered with the Environmental Protection Agency and recommended by the CDC.
        - Permethrin is highly effective in preventing tick bites when applied to clothing, but is not effective when applied directly to the skin. Two options are available for Permethrin treatment of clothing worn during field work: 1) pre-treatment of fabric by the clothing manufacturer; or 2) manual treatment of their personal clothing using Permethrin spray in accordance with recommendations manufacturers recommendations. This will likely require treatment at home or the office prior to field mobilization. Caution should be used when applying Permethrin as it is highly toxic to fish and house cats. AECOM strongly recommends the first option (employees obtaining pre-treated clothing) to avoid the time required, potential risk, and housekeeping issues involved with manually treating the clothing with spray. Purchase pre-treated clothing in accordance with *S3AM-208-PR1 Personal Protective Equipment* and with the approval of your Supervisor or Manager.
        - The Permethrin pre-treatment is odorless and retains its effectiveness for approximately 25 washings. After 25 washings, the pre-treated clothing will be

considered no longer effective and removed from service. Clothing that has been manually treated by employees will be considered effective for five wash cycles.

- Also, use of clothing that has been pre-treated with Permethrin offers a reduction in the use and application of other insect repellents that shall be applied directly to the skin. Supervisor or Manager approval is required prior to purchase.
- If the employee opts not to utilize chemically pre-treated clothing while potentially exposed to insects, spiders and/or ticks, they shall either: 1) wear Tyvek® coveralls taped to the boots, or 2) wear full-length clothing consisting of long-legged pants and long-sleeved shirts treated with an insect repellent containing Permethrin, DEET, or an oil of lemon eucalyptus to their work clothing.
- Safety Data Sheets (SDS) for the repellents, lotions, and cleansers discussed in this Procedure are not required because the repellents, lotion, and clothing are consumer products used in the manner intended for the general public. Although not required, a SDS should be obtained for the products used and placed into the office SDS library and site-specific safety plan.

4.8 Poisonous Plants

4.8.1 Habitat Avoidance, Elimination and/or Control

- If poisonous plants are identified in the work area, employees will mark the plants using either flags or marking paint, and discuss what the specific indicator will be to signal to other employees to avoid the designated area. If employees decide to use ground-marking paint to identify poisonous plants, they should discuss this tactic with the Manager (and Client as appropriate) for approval.
- If removal of the plants is considered, it should be subcontracted to a professional landscaping service that is capable and experienced in removing the plant. If herbicides are considered for use, a discussion shall need to occur with the Manager (and Client as appropriate) to determine whether it is acceptable to apply herbicides at the work site. Application of herbicides may require a license.
- Employees shall not attempt to physically remove poisonous plants from the work area unless a clearing procedure, including PPE, is prepared in advance and approved by the SH&E Manager. The clearing procedure should be included in the SH&E Plan and THA and the required PPE specified.

4.8.2

Poisonous plants that employees should recognize and take precautions to avoid include: poison sumac, poison ivy (terrestrial and climbing), poison oak, giant hogweed[2] (or giant cow parsnip), wild parsnip, devil's club and stinging nettle. Many others are extremely poisonous to eat (e.g., poison hemlock; water parsnip) – do not eat anything that has not been identified. Refer to *S3AM-313-ATT5 Plants of Concern* for information on locations where some of these poisonous plants are found in the U.S.

- Of the toxic plants in the cashew family, poison ivy (*Rhus radicans*) is most widespread. It grows in a variety of forms such as a low sprawling shrub, dense ground cover, or a thick woody vine that grows high into the tree canopy. Poison oak (*Rhus diversiloba*) is typically a low shrub in drier soils. Both of these plants have leaves of three and white berries. Poison sumac (*Rhus vernix*) is a tall shrub that is less prolific in distribution. It grows in wet areas, has a compound leaf with a red leaf stem (rachis), and white berries. All of these plants possess urushiol oils in all parts of the plant. Touching the plant causes an itchy skin rash that can show up within 4-72 hours following contact. People have a wide range of reactions including swelling, itching, rash and bumps, patches or blisters.
- Uroshiol oil can also transfer onto clothing and equipment. The oil can remain active on surfaces for up to 5 years and can be transferred to your skin.

[2] Phytodermatisi producer: keep skin covered and wash well after exposure

- Wild parsnip is found throughout the U.S. and contains a poison that produces a rash similar to poison oak and ivy. Unlike poison oak and ivy, the active oil will not be present on unbroken leaves. See *S3AM-313-ATT6 Wild Parsnip Identification* for additional information and photos of wild parsnip.
- Several plants in the carrot family contain toxic sap that causes severe dermatitis if it comes into contact with skin that is then exposed to sunlight. The most serious reaction is caused by the giant hogweed (*Heracleum mantegazzianum*), a plant that is spreading in southern Ontario and is also present in southwestern British Columbia. The plant is enormous, attaining up to 16 feet (5 meters) in height, which it does in one growing season. Contact causes painful blistering that can cause permanent disfigurement. It is to be avoided. Similar but less serious reactions can be caused by meadow parsnip (*Pastinaca sativa*) and cow parsnip (*Heracleum lanatum*). Meadow parsnip can be very abundant on disturbed sites.
- Nettles, particularly stinging nettle (*Urtica dioica*) and wood nettle (*Laportea canadensis*) contain urticating hairs on the leaves and stems that cause sharp pain or itchiness on contact with skin. The irritation is immediate and normally lasts no more than an hour and there are no lasting consequences.
- Some plants contain abundant stiff spines that can present a safety hazard, particularly if one is to fall into them. These include the cactus (*Opuntia spp.*), devils club (*Oplopanax horridum*), and prickly-ash (*Zanthoxylon americanum*).

4.8.3 A large number of plants are not harmful to touch but may contain poisonous berries or foliage that could cause serious complications or death if they are ingested. It goes without saying to not eat any berries or plants if you are unsure of their identity.

- Remember that in the fall and winter the hazard still exists in the form of stubble and roots.

4.8.4 Personal Protective Equipment (PPE)

- Employees conducting clearing, grubbing, or similarly disturbing work activities in areas where poisonous plants exist shall wear long-sleeve clothing or Tyvek® coveralls, and disposable cotton, leather or synthetic gloves. Employees shall not touch exposed skin (neck and face) with potentially contaminated gloves. Tyvek® and gloves worn to protect from exposure to poisonous plants shall be treated as contaminated, removed from the body in a manner that the contamination is not spread, and placed in plastic bags for disposal.
- Personal clothing that has been exposed to poisonous plants shall be decontaminated with a poisonous plant cleanser such as Tecnu® or removed in a careful manner, bagged and washed separately from other clothing to remove urushiol.
- Work boots will be decontaminated with either soap and water or a cleansing agent such as Tecnu® cleanser.
- If foliage is being cleared and includes poisonous plants, exposed skin shall be treated with a dermal barrier cream such as Tecnu®'s Oak 'n Ivy Armor or Enviroderm's Ivy Block and either a full-face respirator or a half-face respirator (with goggles) fitted with a P-100 (HEPA) dust filter.

4.9 Bird Droppings and Biological Soil Hazards

4.9.1 Work in any area where pigeons or other flying animals (e.g. bats) may nest requires a written statement from the client which states the potential for, and extent of, accumulation of excrement on/in the structure from pigeons or other winged animals.

4.9.2 Substantial accumulations of droppings can pose physical and health risks as slippery surfaces (if wet) and if the material is disturbed and becomes airborne, it can be inhaled or ingested if personal hygiene practices are not implemented. Inhalation of airborne droppings can cause diseases such as histoplasmosis. Exposure to surfaces with bird droppings shall be safeguarded by implementing proper work practices, training employees for awareness and using PPE. See *S3AM-313-ATT8 Bird Droppings*.

4.9.3 Tularemia is a problem with contaminated soil in some locations. Tularemia is a disease of animals and humans caused by the bacterium *Francisella tularensis*. Rabbits, hares, and rodents are especially susceptible and often die in large numbers during outbreaks. Workers can contract Tularemia through tick and deer fly bites, but also through inhalation of contaminated aerosols or agricultural dusts. Check work areas for carcasses before disturbing the ground (e.g. mowing, brushing, grubbing, excavation, etc.).

4.10 Personal Hygiene and Body Checks

4.10.1 Tick-borne diseases typically require that the tick be imbedded for four hours to begin disease transfer. The oils from poisonous plants can take up to 4 hours after exposure to penetrate the skin and react with the live proteins under the skin.

4.10.2 It is recommended that exposed skin be checked frequently for the presence of ticks, insects, rashes, or discolorations. External clothing should also be checked for the presence of ticks and insects; these should be retained for identification and to determine if medical treatment is needed.

4.10.3 Employees shall shower as soon as practical after working in the field and examine their bodies for the presence of ticks, insect bites, rashes, or swollen areas. If imbedded ticks are found, they should be removed using the technique described in *S3AM-313-ATT2 Ticks*.

4.11 Employees shall immediately notify their Manager or Supervisor of the presence of an imbedded tick, bee, wasp or hornet sting, other insect bite, rash, or any abnormal reaction. Reporting shall occur within 4 hours for a significant incident and 24 hours for all other SH&E incidents, and in accordance with *S3AM-004-PR Incident Reporting, Notifications & Investigation.*

4.12 The Manager or Supervisor shall forward the report to the SH&E Manager for follow up.

5.0 Records

None

6.0 Attachments

6.1 S3AM-313-ATT1 Biological Hazard Assessment Flow Chart

6.2 S3AM-313-ATT2 Ticks

6.3 S3AM-313-ATT3 Poisonous Spider Identification

6.4 S3AM-313-ATT4 Mosquito Borne Diseases

6.5 S3AM-313-ATT5 Plants of Concern

6.6 S3AM-313-ATT6 Wild Parsnip Identification

6.7 S3AM-313-ATT7 Alligators

6.8 S3AM-313-ATT8 Bird Droppings

6.9 S3AM-313-ATT9 Large Carnivores & Ungulates

6.10 S3AM-313-ATT10 Bear Safety

6.11 S3AM-313-ATT11 Small Mammals

6.12 S3AM-313-ATT12 Snakes & Scorpions

Americas

Working On & Near Water

S3AM-315-PR1

1.0 Purpose and Scope

1.1 Establishes the minimum requirements and guidance for AECOM personnel assigned to projects that place them at risk of falling into water where a drowning hazard exists (e.g., more than 3 feet / 1 meter deep, fast-moving stream, water body with soft bottom creating entrapment hazard), including working ashore, near to, or over water or ice.

1.2 Employees performing tasks involving work on or under bridges, or on larger vessels, barges, or boats, who are constantly protected by guardrail systems, nets, or body harness systems are deemed to be adequately protected from the danger of drowning, and are not required to wear life jackets or buoyant work vests.

1.3 Projects conducted on a ship at sea or in port may not be required to comply with parts of this procedure provided:

- AECOM can demonstrate the hazard and related controls as identified in this procedure are adequately addressed through controls established by another controlling entity (e.g. ship owner/operator, port authority, etc.) and these are available to AECOM personnel.
- If AECOM cannot demonstrate adequate controls are in place, the related requirements of this procedure shall be met.

1.4 This procedure applies to all AECOM Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 **PFD** – Personal Flotation Device

2.2 **Life Jacket** – A personal flotation device that will turn over an unconscious worker in the water so their face and nose are not submerged.

2.3 **USCG** – United States Coast Guard

2.4 **Lifebuoy** – A throwable buoyant rescue ring with 90 feet (28 meters) buoyant line attached.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-208-PR1 Personal Protective Equipment

3.3 S3AM-209-PR1 Risk Assessment & Management

3.4 S3AM-333-PR1 Marine Safety & Vessel Operations

3.5 S3AM-334-PR1 Diving

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 Manager

Responsible for the overall success of a project and the performance of employees engaged in project activities (with the support of Supervisors), and as follows:

- Confirm that all appropriate Safety, Health and Environment (SH&E) procedures are identified and implemented and their applicability during the planning stage of field investigation projects.

- Allocate appropriate resources to implement the required measures.
- Designate a field staff person to implement and maintain these measures, maintain related documentation, and to communicate with appropriate parties as necessary.
- Consult with the purchasing department on the appropriate vendors for rentals/leases.
- Confirm that boat/watercraft rental/leasing vendors have appropriate paperwork (licenses, insurance, maintenance records, orientations, etc.).
- Confirm that the project is properly staffed with trained employees.
- Require that at least one employee trained in cardiopulmonary resuscitation (CPR) and first aid is on site during work activities.
- Designate at least one employee on site to respond to water emergencies and, as applicable, operate the rescue boat at times when there are employees above, in, or near water.
- Develop and submit a SH&E Plan and other relevant SH&E planning documents for review and approval by the SH&E Manager.
- Develop a written section in the SH&E Plan (or equivalent document) to address worker safety, water rescue, and personnel transfer procedures as required in this standard.
- Confirm Task Hazard Assessments (THA) are completed prior to tasks commencing.

4.1.2 SH&E Manager

Responsible for providing support to the Manager and his/her designee in the evaluation of safety and health risks and the identification of applicable policies, procedures, and appropriate precautions, and as follows:

- Review all project related SH&E Plans and THAs as required.
- Provide access to safety records, including training records, for field staff.
- Provide support to Manager.

4.1.3 Supervisors

Responsible for verifying current status of applicable staff's training and equipping them for the work at hand, and as follows:

- Conduct daily safety meetings to include a review of the hazards and control measures associated with working over/near water. Refer to *S3AM-209-PR1 Risk Assessment & Management.*
- Train employees on their responsibilities, the hazards and the control measures associated with working over/near water.
- Perform SH&E inspections.
- Confirm that all safety issues and equipment deficiencies are properly corrected, and that the proper equipment is available to the field staff to safely meet the goals and quality objectives of the project.

4.1.4 Employees

Responsible for complying with the safe work practices specified in this policy and all other applicable SH&E policies or procedures and reporting all unsafe working conditions, and as follows:

- Review, contribute to, and sign the SH&E Plan prior to beginning the project and whenever new tasks or environmental changes occur.
- Review, contribute to, and sign the THA prior to initiating the associated task.
- Confirming that their SH&E training is up to date.
- Confirming daily that equipment is properly maintained and functioning.
- Confirm they wear all required Personal Protective Equipment (PPE).

4.2 General Safety Considerations

4.2.1 During project preparation, consideration shall include, but not be limited to**:**

- The location and nature of the site.
- Type of water hazard.
- Underwater hazards and structures.
- Access to the worksite and/or water body.
- Scope of work.
- Equipment to be used
- Local climate.

4.2.2 The information shall be considered when determining the appropriate controls, PPE, and level of emergency preparedness that is required. All projects working near water hazards shall have an appropriate SH&E Plan and THA prepared. Refer to *S3AM-209-PR1 Risk Assessment & Management*.

4.2.3 PPE specified in the SH&E Plan and THA is to be worn as required, to meet the specific regulations of the work area, including as applicable, local and Federal legislation.

4.2.4 Whenever there exists the possibility of falling into water, personnel shall be attired in a USCG approved Type III or Type V PFD or Life jacket. Refer to *S3AM315-ATT1 Personal Floatation Devices*. The vest shall be properly sized for the individual and shall be secured at all times. For cold water conditions (water temperature less than 55 degrees Fahrenheit [13 degrees Celsius]), a USCG-approved Shallang/Mustang suit shall be worn to protect personnel from risks of cold water immersion.

4.2.5 For work at night, Type II, III, or V PFD should have a chemical light, or other appropriate survival light attached to facilitate rescue. All PFDs shall have reflective tape on them to facilitate visibility at night. For work in non-US areas, the PFD shall be approved by the appropriate local authority, or be approved as an International Maritime Organization (IMO)/Safety of Life at Sea (SOLAS) lifesaving device. This shall include either a Type II buoyant vest or a Type III flotation aid.

4.2.6 Swimming is prohibited, unless it is being conducted by certified divers in the completion of their assigned task, or to prevent a serious injury or loss of life in a person in a water/person overboard emergency.

4.2.7 The buddy system shall be utilized whenever there is the possibility of falling into water, in which two persons operate as a single unit in order to monitor and assist each other in performing tasks.

4.2.8 When work is performed in water where a drowning hazard exists, or on ice, at least one attendant and/or rescue boat operator will be utilized and be available to immediately respond to an emergency and/or launch the rescue boat. The attendant and/or boat operator are not to be assigned other duties beyond safety and rescue.

4.2.9 Conducting shoreline work alone should be avoided, unless constant communications is maintained between Staff and Supervisors, and prior approval by the Manager is granted.

4.2.10 Confirm a throwable lifebuoy with required rescue line attached (Type IV PFD) is available.

4.2.11 Confirm any additional equipment (e.g.,, sounding alarms, lifting gear, or rescue boat) as required by legislation is immediately available to recover an individual from the water.

- If the shortest dimension of the water body is greater than the length of line attached to the throw buoy, a skiff or boat shall be available to facilitate a rescue.
- The rescue boat shall be capable of being launched by one person, and shall be properly equipped, and the operator shall be properly qualified per *S3AM-333-PR1 Marine Safety & Vessel Operation*.
- If a rescue boat is not feasible due to site conditions (e.g., water depth), alternate rescue planning shall be provided in the safety plan.

4.3 Personal Protective Equipment (PPE)

4.3.1 PPE shall be selected based on the SH&E Plan and THA, and in accordance with the *S3AM-208-PR1 Personal Protective Equipment*.

4.3.2 The minimum PPE required for wading in water above the knees includes:

- Personal Flotation Devices or lifejackets shall be worn by all workers who are exposed to the danger of drowning in water deep enough for the lifejacket to be effective.
- All inflatable PFD or life jackets shall be approved and have documented regular inspections.
- Shallang/Mustang suits – In water temperatures below 55 degrees Fahrenheit (13 degrees Celsius) (regardless of air temperature) personnel are required to wear a USCG-approved Shallang/Mustang jacket or full-flotation suit, depending on field conditions. This requirement will replace the need for a wearable PFD as these suits (if properly maintained) will provide adequate flotation.
- Waders shall have a slip resistant sole suitable for the substrate.
- Eye protection shall be worn to reduce glare.
- Wading pole shall be used for supporting and testing the substrate before wading.

4.3.3 Confirm rescue equipment is on site that is appropriate to the situation (e.g., life buoys with 90 feet [28 meters]) of retrieval line, rescue boat, sounding device). Extra buoys shall be 200 feet (60 meters) or less from each other. During night operations, ring buoys shall have a USCG or SOLAS equivalent water light attached.

4.3.4 Confirm appropriate emergency supplies are available at the location (e.g. blankets, first aid kit).

4.3.5 Immersion suits, or survival suits as they are often called, can significantly improve survival time in cold water.

- Recognizing that hypothermia is a major factor in lives lost at sea, the USCG requires that vessels operating in offshore waters north of 32 degrees North latitude carry an immersion suit for each person aboard.
- These suits are to be used in place of a Type I PFD in an abandon ship situation.
- It is recommended that personnel familiarize themselves with their use and practice donning the suit before leaving the dock. It is recommended that personnel be able to get into an immersion suit in under a minute.
- If necessary to abandon ship, personnel, attired in an immersion suit with head covered in a hat, should enter the water slowly. If possible, keep the head out of the water.

4.3.6 Suits should be stored in a clean and dry location. Avoid stacking or compressing the suits in storage as it may result in a loss of buoyancy. Federal regulations require that immersion suits be stowed so that they are readily accessible to the individual for whom they are intended, from both the individual's normal work area and berthing area. If there is no location readily accessible to both areas, then a suit shall be stowed at each location.

4.4 Land-based water work (shoreline/bridge/pier – includes wading)

4.4.1 All shore work shall be performed in accordance with a "Buddy System".

4.4.2 If sampling near or in flowing water environments, be aware of slippery or steep banks and fast currents. If the current is fast or the water looks deeper than knee height, do not enter the water. If you must enter the water, a PFD and restraining system shall be worn and secured to the bank for your retrieval in the event of an emergency.

4.4.3 Whenever possible, positive controls in the form of fencing or barricades should be considered for long-term waterfront projects to form a security perimeter 10 feet in from the water's edge to prevent field staff from being exposed to water hazards.

4.4.4 Field staff involved in sampling contaminated sediments or surface waters or conducting shoreline surveys may require a Hepatitis A and/or tetanus vaccination depending on site conditions and are advised to consult with their Safety, Health and Environment Manager. An Occupational Safety

and Health Administration 40-hour HAZWOPER may be required for field staff working on site if warranted by the Project.

4.4.5 Take special care on slippery rocks along shorelines, lakeshores, riverbanks, and creeks. Always look ahead at the ground when walking around the water's edge and avoid stepping on stones that have algal growth, especially those in intertidal areas, as these are extremely slippery. It is suggested that workers not be permitted to access areas where these slip/fall hazards exist, especially in locations containing tidal water flow.

4.4.6 Personal Protective Equipment:

- AECOM requires that whenever there exists the possibility of falling into water, field staff shall be attired in a USCG-approved Type III or Type V work vest. This includes when working near fluid-filled tanks, ponds, lagoons, or natural waterways.
- The PFD vest shall be properly sized for the individual and shall be secured at all times. Prior to and after each use, the PFD/suit shall be inspected for defects, which may alter their strength or buoyancy. Defective units shall be discarded and replaced.
- Staff protective gear shall include long pants with adequate puncture resistance, and gloves appropriate to the hazard(s) (e.g., puncture resistant gloves such as Kevlar when sampling, picking up, or manipulating ground cover). It is recommended that field staff use a rake to move ground cover and debris and not touch these items directly by hand whenever possible.

4.5 Wading in a shallow stream or water body:

4.5.1 Chest waders may not be worn when working along, over, or in moving waters; or in waters influenced by tides or acted upon by waves when water depths exceed knee height unless specifically approved by the Manager.

- Chest waders may be worn in still waters in water depths up to the waist if bottom conditions are firm and well understood.
- Chest waders shall never be worn aboard a watercraft of any kind unless specifically approved by the SH&E Manager and required by the task (e.g., rubber or neoprene waders for electrofishing to protect from electric shock).

4.5.2 Always proceed upstream so that the wading team is walking into clear water (no turbidity caused by walking), there is good visibility for any debris floating downstream, and there is a reduced risk that the wading team will be pushed against debris or pushed into a deep hole by the current.

4.5.3 Wading in water deeper than knee height shall be undertaken as a two-person crew unless alternative suitable measures to control the hazard are employed. If conditions or legislation warrant a "rescue team," then an appropriately sized crew should be used, with the rescue team stationed on the shore with the appropriate rescue equipment, as per the site-specific safety plan.

4.5.4 Wading will not occur in the following circumstances:

- If the water is too turbid or too deep to see tripping hazards or deep holes.
- If it appears the bottom is composed of soft sediments where stepping in may result in sinking, or if the bottom consists of clay where slipping is likely.
- If large woody debris is abundant and will be difficult to step over or move around.
- If the water is over the waist of the shortest person on the wading teaming. This does not preclude wading in water bodies that have shallow shorelines that grade into deeper waters. By not wading over waist level there will be approximately 12 Inches (30 centimeters) of "safety distance" on the chest waders (if worn), should a member of the wading team step or slip into a deeper area.
- If there is a risk of the current pushing a member of the team downstream.
- If there is a risk of exposure to dangerous wildlife, or other hazardous conditions, unless appropriate mitigation procedures are in place.

4.6 Cold Water Operations

4.6.1 Cold water operations are defined as any situation that exposes an individual to falling into water that has a temperature of 55 degrees Fahrenheit (13 degrees Celsius) or less.

4.6.2 Sudden immersion in cold water can induce a gasping reaction and uncontrolled breathing which may cause the victim to ingest water and begin choking, experience cardiac arrest, and other physical body conditions all of which can result in a quick drowning.

4.6.3 Cold water incapacitation precedes hypothermia, making swimming and grasping for safety extremely difficult. So while death by hypothermia may occur in roughly one hour in a water temperature of 55 degrees Fahrenheit (13 degrees Celsius), incapacitation due to failing muscle function will occur in as little as 10 minutes, so regardless of your age, physical conditioning, or ability to swim – your odds of survival are greatly enhanced if you wear a life jacket.

4.6.4 AECOM requires personnel to wear a USCG-approved Shallang / Mustang suit at all times whenever there is the risk of falling into cold water. Employees working in these conditions view a training video on the physiological effects of cold water immersion found at: http://www.coldwaterbootcamp.com.

4.6.5 Consideration should be given to the use of immersion of survival suits when project work involves cold water operations.

4.6.6 Water and ambient air temperatures shall be directly measured at the start of each work shift, and no less than once daily. Shift/daily temperature records will be maintained in the site or field notes.

4.7 Working on Ice

4.7.1 Working in situations where ice exists shall be strictly limited due to the extreme hazards associated with falling through the ice cap, cold water immersion, and the logistical difficulties associated with executing a rescue.

4.7.2 Specific information and procedures for working on ice can be found in *S3AM-315-ATT2 Ice Safe Work Practices*.

4.7.3 Ice conditions (e.g., thickness, color, cracking) shall be recorded at the start of each work shift, and no less than once daily. Ice condition records will be maintained in the site or field notes. If ice conditions do not meet the criteria specified in *S3AM-315-ATT2 Ice Safe Work Practices*, then work shall not proceed until the required conditions are met.

4.7.4 Personnel working in or on ice shall be attired in a USCG-approved Shallang / Mustang survival suit and be supported by shore side personnel to assist in recovery in the event of a break through. Depending on the nature of the project, on-ice personnel should either wear a harness tethered back to shore, or push a flat bottom boat along on the ice and have the boat tethered back to shore.

4.7.5 Personnel working on ice covered waters should dramatically reduce vessel speed to avoid damaging propellers, shafts, and rudders. Personnel should be cognizant of shoreline ice which can prevent access to alternative ramps and docks that were considered as egress points in emergency planning.

4.7.6 Personnel should be wary that boat ramps on tidally influenced waters can flash freeze at low tide, precluding or compromising safe access and egress.

4.7.7 Extra safety equipment:

- Extra blankets should be kept on site (in a vehicle) when working on or near frozen water bodies.
- An ice pick, ice chisel, and/or ice auger should be used by a member of the crew with experience or training in identifying thin or weak ice.
- A braided rope, preferably 98 feet (30 meters) in length.

4.8 Emergency Response

4.8.1 Emergency preparedness applies to any work where there exists the risk of falling into water, especially moving waters, along piers, bulkheads, and river banks with a sharp drop off in bathymetry.

4.8.2 Field staff working in or alongside waters, especially moving waters, where there exists the possibility of falling in shall have an Emergency Response Plan to recover someone in the event they have fallen in.

4.8.3 A throwable rescue device (Class IV PFD) shall be immediately available in the event of an emergency situation. In these situations the position and accessibility of throw rings and other rescue devices (e.g., ladders) and the mechanism to recover a person from the water shall be considered.

4.8.4 The number and placement of ladders and throw rings shall be sufficient so that the maximum swimming distance to them is no more than 25 feet.

4.8.5 If workers have the potential to get stuck in mud or fluidized sediment, air injection equipment designed to free worker's feet/legs may need to be available on site. At a minimum, a safety line should be available to be deployed from safe ground. If a worker does get stuck, they should not struggle as this causes further sinking. Use a pole to conduct sediment probing to assess water depths, the stability of shoreline terrain, and the bearing capacity of bottom sediments ahead of the chosen path.

4.9 Training

- All Staff and Managers working on projects with exposure to open water shall receive training in their applicable tasks, the hazards, precautions, and rescue procedures associated with working in or over water, refer to the *S3AM-003-PR1 SH&E Training* program.
- All staff working on or near frozen water bodies shall complete Ice Safety Awareness training.
- Staff who will be working on frozen water bodies regularly or for extended periods of time should take an Ice Rescue Training course, or obtain management approval based on their level of experience/competence working on ice.
- Staff working near cold water shall complete awareness level training on Cold Water Immersion.

5.0 Records

5.1 None

6.0 Attachments

6.1 S3AM-315-ATT1 Personal Floatation Devices

6.2 S3AM-315-ATT2 Ice Safe Work Practices

Americas

Material Storage

S3AM-316-PR1

1.0 Purpose and Scope

1.1 This procedure applies to all AECOM Americas-based employees and operations, and any other entity and its personnel contractually required to comply with this document's content, where materials are stored and used. Note that this standard does not address manual material handling (e.g., manual lifting, lowering, pushing, pulling, carrying, holding, or restraining). Information on manual material handling can be found in *S3AM-014-PR1 Manual Lifting*.

1.2 The purpose of this standard is to ensure the safety of AECOM personnel during the storage of materials.

2.0 Terms and Definitions

2.1 None

3.0 References

3.1 S3AM-014-PR1 Manual Lifting

3.2 S3AM-115-PR1 Hazardous Materials Communication

4.0 Procedure

4.1 Implementation of this standard is the responsibility of the Manager directing activities of the facility, site, or project location.

4.2 Employees shall be properly trained and follow the established procedures applicable to the material stored.

4.3 General

4.3.1 Consult additional applicable jurisdictional requirements and AECOM procedures for specific tasks, materials, and equipment involved in material storage operations.

4.3.2 Storage areas should be specifically designated and be clearly marked. Aisles should be clearly marked, be of ample width for the type of storage, and be kept free from obstacles and trash.

4.3.3 Store materials in a manner that prevents damage or deterioration to the material and in a configuration that is safe and provides for the optimal and efficient use of storage space.

4.3.4 Material must not be stacked within 18 inches of the sprinkler heads Material should be kept well clear of light fittings, heating pipes and ceilings.

4.3.5 Ensure that stacks are stable and self-supporting.

- Stack symmetrically.
- Base areas and heights of stacks should be kept as small as circumstances permit. The ratio of height to base dimensions of large stacks should be correctly proportioned so that failure of part or whole of the stack does not occur.
- Experience has shown that the height to base ratio of an unsupported stack should not exceed 3 to 1.
- As most stacks are erected by visual alignment, a slight error in calculation near the base can easily result in a barely noticeable overhang, with a resultant loss of stability.

- Where effective banding and shrink wrapping can be achieved, the ratio of height to base can be safely increased to 4 to 1.
- Stable construction of the stack is entirely dependent upon the following factors:
  - Safe relation of height to dimension of base;
  - Sound interlocking of the material;
  - Contents of the cartons;
  - Shape of articles

4.3.6 Post maximum safe loads for all floors above grade in pounds per square foot.

4.3.7 As applicable, stack, rack, block, interlock, band or shrink-wrap, or otherwise secure all materials to be stored in tiers to prevent sliding, falling, or collapse.

4.3.8 De-stacking is largely the reverse process of stacking. Most accidents involving the collapse of stacked materials occur during de-stacking. The prime cause of this is haphazard removal. All stacking and de-stacking should be carried out under competent supervision. Basic rules for breaking down stacks are:

- One person should be responsible for the manner in which the stack is reduced;
- The stack should be taken down tier by tier and;
- As there is a high tripping hazard in the working area of a stack, tidiness and systematic work methods are essential.

4.3.9 Keep aisles, passageways, and other access ways clear to provide for the free and safe movement of material-handling equipment or employees. Mark all permanent aisles.

4.3.10 Segregate and label non-compatible materials. Refer to *S3AM-117-PR1 Hazardous Materials Communication*.

4.3.11 When loads swing freely, confirm non-compatible materials are segregated. Do not lift loads or swing over the heads of persons; it is not permitted to walk under a load. Wear hardhats in these areas.

4.3.12 Do not place material stored inside buildings under construction within 6 feet (1.8 meters) of any hoistway or inside floor openings, or within 10 feet (3 meters) of any exterior wall lower than the top of the material stored.

4.3.13 Pallets should be of sound construction, and be of adequate strength for the loads and conditions under which they are used. Where pallet loads are stacked tier on tier, the unit loads must be able to support the weight above.

4.3.14 Stacks, shelving and other fixtures for holding or storing materials should be so laid out and designed that there is sufficient access for safe loading and unloading by either manual or mechanical means

4.4 Stacking Frames

4.4.1 Conduct a visual inspection of the stacking frames prior to loading for damage (e.g., bent, twisted, broken or excessive rust). Remove from service any stacking frames that fall into any of these categories.

4.4.2 Several pallets can be loaded on a stacking frame provided they are stable and will not fall.

4.4.3 If more than one (1) pallet is placed on a stacking frame and materials are unstable or appear to be capable of falling, the pallets will be shrink-wrapped or banded together or stored in another storage location.

4.4.4 Do not exceed the maximum load of the stacking frame. Be sure to include the weight of the stacking frame in the maximum load calculation.

4.4.5 Material on a stacking frame will not extend above the top rail if another stacking frame is to be placed on top of the lower frame.

- The highest or top stacking frame may have material that extends above the top rails, but the pallet itself must be below the top rails and the material secured.

4.4.6 Stacking frames will only be stacked high enough for forklift forks to be able to reach and remove one (1) frame at a time. At no time will they be stacked higher than five (5) high regardless of the dimensions of the stacking frame. Material placed on the top rack will be banded or shrink wrapped (if applicable).

4.4.7 Do not mix stacking frames manufactured by different companies (e.g., a UNICOR with a Nestainer or other manufacturer).

- Stacking frames of different colors can be intermingled but will be of the same dimensions and manufacturer (e.g., UNICOR to UNICOR, Nestainer to Nestainer).

4.4.8 The 1st (lowest) stacking frame will have the greatest amount of weight. The subsequent frames will, if possible, have less weight than the frame immediately below it. This is to avoid top heaviness.

4.4.9 When picking up a stacking frame, ensure the MHE forks are securely seated into the two (2) stirrups of the frame. When traveling, maintain a clear field of vision and travel in reverse if vision is obstructed by the load. Sound your horn at all intersections and blind spots.

4.4.10 Transport one (1) loaded stacking frame at a time.

4.4.11 When traveling with a pallet, keep load as low as possible. Do not bulldoze pallets or stacking frames.

4.5 Bagged Materials

4.5.1 Provide bags of cement and lime stacked over ten bags high with restraining walls of appropriate strength.

4.5.2 Stack cement, lime, and similar materials in bags so that the mouths of the outside bags are facing the center of the stack.

4.5.3 During un-stacking, keep the entire top of the stack nearly level, and maintain the necessary setback.

4.5.4 Warn employees handling cement or lime about skin burns, and ensure that goggles, gloves, and clothing that fits snugly about the neck and wrists are worn.

4.5.5 Lime must be stored to prevent a premature slaking action that may cause fire.

4.6 Bricks and Blocks

4.6.1 Brick stacks must not exceed 7 feet (2.1 meters), and they should be tapered back starting at 4 feet (1.2 meters).

4.6.2 Always stack bricks on planks, asphalt, or concrete, and never on uneven or soft surfaces.

4.6.3 Keep the top of brick stacks level and maintain the taper during un-stacking operations.

4.6.4 Stack blocks in tiers on solid, level surfaces, and taper back over the 6-foot (1.8-meter) level.

4.7 Lumber

4.7.1 When stacking lumber, place cross strips on stacks more than 4 feet (1.2 meters) high.

4.7.2 Remove all nails from used lumber before stacking, unless the lumber is to be burned or hauled away without further handling.

4.7.3 Stack lumber on level and solidly supported sills to be stable and self-supporting.

4.7.4 Do not stack lumber more than 16 feet (4.9 meters) high.

4.8 Reinforcing and Structural Steel

4.8.1 Store steel rods in separate stacks according to length and size.

4.8.2 Carefully stack structural steel to prevent the danger of members sliding off, or the stack toppling over.

4.8.3 Never store “I” beams with the webs vertical.

4.9 Foundation Bolts

4.9.1 Stack bolts in separate stacks according to length and size.

4.10 Corrugated and Flat Iron

4.10.1 Stack corrugated and flat iron flat, and not more than 4 feet (1.2 meters) high.

4.10.2 Place spacing strips between bundles.

4.11 Pipes, Poles, and other Cylindrical Material

4.11.1 Stack and block cylindrical material in such a way to keep the material from spreading or toppling.

4.11.2 Do not stack pipes higher than 5 feet (1.5 meters) unless racked.

4.11.3 When removing pipe or other material larger than 2 inches (5 centimeters) in diameter from storage, and where stacked pipe runs in one direction and is more than one pipe high, employees will be instructed to approach the stack from the ends, not from the sides.

4.12 Sand, Gravel, and Crushed Stone

4.12.1 While removing sand, gravel, and crushed stone from stockpiles, ensure there are no overhanging or vertical faces at any time.

4.12.2 Do not store material dumped against walls or partitions to a height that will endanger the stability or exceed the resisting strength of such walls and partitions.

5.0 Records

5.1 No documentation maintenance is required.

6.0 Attachments

6.1 None

Americas

Pre-Drilling, Boring & Direct Push Probing Flow Chart

S3AM-321-ATT2

Before Any Drilling, Boring and Direct Push Probing Activities

PERMITS and ACCESS AGREEMENTS

- **Government and Utility/Infrastructure Permits**
- **Client Permits and Procedures**
- **Access Agreements**

KEY POINT: Obtain all permits and sign Access Agreement (if required).

GENERAL HEALTH and SAFETY

KEY POINT: Prepare SH&E Plan, as well as Task Hazard Assessments (THA).

IDENTIFICATION and MAPPING OF UTILITY and SUBSURFACE STRUCTURES

KEY POINT: Generate a comprehensive site map illustrating known locations of overhead/subsurface utilities, subsurface structures, and proposed boring locations.
Review completed *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist*.

SITE WALK

KEY POINT: Perform a site walk utilizing site map and 360 degree view to verify known conditions, including overhead obstructions or hazards, and identify potential issues. Add discovered items/issues to map for use in location confirmation.

PROPOSED SUBSURFACE INVESTIGATION LOCATIONS

KEY POINT: Confirm that locations meet the minimum required set-back distances.

UTILITY CLEARANCE INVESTIGATION LOCATION CONFIRMATION

KEY POINT: Visually verify hand clearance. Review completed *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist*.

DRILL RIG INSPECTIONS

KEY POINT: Drill rig inspected and documented daily by operator prior to drilling.

BEGIN DRILLING, BORING OR DIRECT PUSH PROBING

KEY POINT: Prior to commencing any intrusive subsurface work, *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* shall be completed.
Upon commencing the work, if unanticipated conditions or events are encountered (e.g. concrete/debris, void encountered, etc.) stop work and notify the Manager. Authorization to proceed shall have the concurrence of the Manager, Site Supervisor and SH&E Manager.

Americas

Daily Drilling, Boring & Direct-Push Equipment Inspection

S3AM-321-FM1

Site / Project Name _____ Rig Inspector (Name/Company) _____

RIG INFORMATION:

Rig Type Rotary/Auger Drilling Rig ☐ Direct Push Type (DPT) ☐

Owner _____ VIN# _____

Year/Make _____ Mileage _____

Model _____ Drill Hrs _____

INSTRUCTIONS: Each shift shall inspect all applicable items. If an unsatisfactory condition (fail) is observed, suspend operation of the equipment and report the condition to the site supervisor immediately.

Emergency Equipment / Devices / Switches	
Kill switches are located and accessible to workers on both sides of the rotating stem. NOTE: Location and number of switches depend on the rig manufacturer; please refer to owner's manual (DPT typically has one switch on control panel).	☐ Pass ☐ Fail ☐ N/A
Kill switches installed by the manufacturer, alarms and other devices (e.g. positive air shut-off valve) tested and in operable condition. All workers familiar with location and operation of devices. **NEVER BYPASS, DISABLE, OR REMOVE KILL DEVICES.**	☐ Pass ☐ Fail ☐ N/A
First aid kit adequate and on equipment / readily available.	☐ Pass ☐ Fail ☐ N/A
Absorbent materials on equipment / readily available (spill response).	☐ Pass ☐ Fail ☐ N/A
A fire extinguisher of appropriate size is located on drill rig and readily available/accessible for drilling crew (recommended 20 lbs.).	☐ Pass ☐ Fail ☐ N/A
Protective Guards	
Drive shafts, belts, chain drives, and universal joints are guarded to prevent accidental insertion of hands, fingers, or tools.	☐ Pass ☐ Fail ☐ N/A
Cables	
Cables on drill rig free of kinks, frayed wires, birdcages, flat spots, grease, and worn or missing sections.	☐ Pass ☐ Fail ☐ N/A
Cables are terminated at the working end with a proper eye splice; either swaged, coupled, or using cable clamps.	☐ Pass ☐ Fail ☐ N/A
Cable clamps are installed with the saddle on the live or load side. Clamps are not alternated and are of the correct size and number for the cable size.	☐ Pass ☐ Fail ☐ N/A
Wire ropes are not allowed to bend around sharp edges without cushion material.	☐ Pass ☐ Fail ☐ N/A
Pulleys and Cable Winches	
Pulleys are not bent, cracked, or broken.	☐ Pass ☐ Fail ☐ N/A
Pulleys operate smoothly and freely, without resistance.	☐ Pass ☐ Fail ☐ N/A
Motor is mounted in correct location and tightly secured to drill rig.	☐ Pass ☐ Fail ☐ N/A
Winch capable of being placed in the free spool (unwind smoothly) and locked position correctly, demonstrating that the cable is suitable for lifting during drilling operations.	☐ Pass ☐ Fail ☐ N/A
Safety Latches	
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation.	☐ Pass ☐ Fail ☐ N/A
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load.	☐ Pass ☐ Fail ☐ N/A
Flights / Augers / Reamers	
Flights / Augers / Reamers are not bent, cracked, or broken. NOTE: Flights / Augers / Reamers failing inspection must be removed from jobsite.	☐ Pass ☐ Fail ☐ N/A

Flights are blunt to prevent the risks of cuts.	☐ Pass ☐ Fail ☐ N/A
Auger keys are not bent, cracked/fractured, excessively worn, or otherwise damaged.	☐ Pass ☐ Fail ☐ N/A
Auger bolt holes and threads are not damaged.	☐ Pass ☐ Fail ☐ N/A
Inspect flights/augers for metal burns. NOTE: Burrs must be filed to flat surface.	☐ Pass ☐ Fail ☐ N/A
Augers / Reamers lying flat on the ground (avoid stacking).	☐ Pass ☐ Fail ☐ N/A
Augers / Reamers over 50lbs (22.7kg) moved mechanically. (Avoid manual lifting).	☐ Pass ☐ Fail ☐ N/A
Drill String	
Appropriate break out tool(s) available.	☐ Pass ☐ Fail ☐ N/A
Rod box and power vice operating smoothly and freely.	
Drill string are not bent and do not have any cracks/fractures.	☐ Pass ☐ Fail ☐ N/A
Drill string connections (e.g. pins, threads, couplers) are of the proper type, are not bent, have no cracks/fractures, and are not excessively worn.	☐ Pass ☐ Fail ☐ N/A
Swivel connectors (for trailing horizontal drill stem) lubricated and freely rotating.	☐ Pass ☐ Fail ☐ N/A
Mast	
Mast is free of bends, cracks, or broken sections.	☐ Pass ☐ Fail ☐ N/A
All mounting hardware (pins, bolts, etc.) in place.	☐ Pass ☐ Fail ☐ N/A
No moving of drill rig or maintenance/repairs while mast is in vertical position.	☐ Pass ☐ Fail ☐ N/A
Hammering Device	
Hammer free of cracks, fatigue, or other signs of excessive wear.	☐ Pass ☐ Fail ☐ N/A
Hammer connections are secure.	☐ Pass ☐ Fail ☐ N/A
Leveling Devices	
Outriggers move in/out and up/down smoothly and freely while using controls on drill rig, with no hydraulics leaks.	☐ Pass ☐ Fail ☐ N/A
Outriggers are extended prior to and whenever the mast is raised off its cradle. Outriggers must maintain pressure to continuously support and stabilize the drill rig (even while unattended).	☐ Pass ☐ Fail ☐ N/A
Outriggers are properly supported on the ground surface to prevent setting into the soil (use of outrigger support pads).	☐ Pass ☐ Fail ☐ N/A
Controls	
Controls are intact, properly labeled, have freedom of movement, and have no loose wiring or connections.	☐ Pass ☐ Fail ☐ N/A
Controls are not blocked or locked into an operating position.	☐ Pass ☐ Fail ☐ N/A
Installed lights, signals, gauges, and alarms operate properly.	☐ Pass ☐ Fail ☐ N/A
Lifting Devices	
Slings, chokers, and lifting devices (straps, not chains) inspected before using and are in proper working order. NOTE: Damaged units are labeled and removed from jobsite.	☐ Pass ☐ Fail ☐ N/A
Shackles/Clevises are in proper working order with pins/screws in place that is to be used while lifting.	☐ Pass ☐ Fail ☐ N/A
Cables and lifting devices are not operated erratically or with a jerking action to overcome resistance.	☐ Pass ☐ Fail ☐ N/A
Hydraulic System	
Hydraulic lines are secure, in good condition with no signs of excessive wear, and not leaking. NOTE: Check while pressurized.	☐ Pass ☐ Fail ☐ N/A
Hydraulic lines are not in a bent or pinched position causing additional fluid restrictions/pressures.	☐ Pass ☐ Fail ☐ N/A
Hydraulic oil reservoir has appropriate amount of oil and not leaking.	☐ Pass ☐ Fail ☐ N/A
Documentation available to confirm that pressure relief valve was checked during shop maintenance activity and noted on maintenance log.	☐ Pass ☐ Fail ☐ N/A
Pump Lines (water, grout, etc)	
Suction/Discharge hoses, pipes, valves, and fittings are secured and not leaking.	☐ Pass ☐ Fail ☐ N/A
High pressure hoses have a safety chain, cable, or strap at each end to prevent whipping in the event of a failure.	☐ Pass ☐ Fail ☐ N/A

Ladders	
Drill rig has a permanently attached or proper portable ladder to be used for access to drilling platform.	☐ Pass ☐ Fail ☐ N/A
Ladders and platforms not to be used for tool storage- keep ladders and operator platforms clear during drilling.	☐ Pass ☐ Fail ☐ N/A
Tires / Tracks	
Tires / Tracks on rig are not excessively worn and free of any debris or foreign material.	☐ Pass ☐ Fail ☐ N/A
General	
General condition – exterior (no structural damage, no loose bolts, platform tidy, etc.)	
General condition – interior (cab clean, tidy)	
Drill rig meets regulations for transport on state/federal highways (inspection sticker, license plate, etc.).	☐ Pass ☐ Fail ☐ N/A
Rig is of appropriate size to meet job requirements.	☐ Pass ☐ Fail ☐ N/A
Maintenance log available for previous 3 months to confirm proper maintenance/inspection.	☐ Pass ☐ Fail ☐ N/A
Exhaust	
Exhaust system is free from defect and routes engine exhaust away from drill rig workers.	☐ Pass ☐ Fail ☐ N/A
Fuels	
Fuel stored in an approved and properly labeled container.	☐ Pass ☐ Fail ☐ N/A
Fuel transfer lines free from signs of excessive wear and not leaking.	☐ Pass ☐ Fail ☐ N/A
Refueling and transferring of fuel is performed in an approved area with sufficient containment to prevent spillage.	☐ Pass ☐ Fail ☐ N/A
Exclusion/Work Zones	
The exclusion/work zone is centered over the borehole (and if applicable, bore exit point) and the radius equal to or greater than the height of the mast (measured from ground level).	☐ Pass ☐ Fail ☐ N/A
The exclusion/work zone is clear of tripping hazards or the hazards are documented with appropriate controls on the Task Hazard Assessment.	☐ Pass ☐ Fail ☐ N/A
The exclusion/work zone communicated to concurrent/adjacent operations to prevent overlap of work zones or line of fire.	☐ Pass ☐ Fail ☐ N/A
Subsurface Utilities / Installations and Overhead Obstructions	
Subsurface utilities / installations have been confirmed as identified and cleared through site observation and review of the completed *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist.*	☐ Pass ☐ Fail ☐ N/A
Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to under, by, or near power lines in accordance with the Minimum Approach Distance (MAD).	☐ Pass ☐ Fail ☐ N/A
Rig Repairs	
Repairs, when possible, are conducted offsite to reduce the risk of any onsite incidents.	☐ Pass ☐ Fail ☐ N/A
Specialized PPE	
When working at elevated heights, workers are to wear a fall restraining device attached in a manner to restrict falls to less than six feet (1.83 meters).	☐ Pass ☐ Fail ☐ N/A
When working in wet/slippery conditions, all workers have a lug-type sole or similar slip resistant sole, on their safety footwear to prevent slipping.	☐ Pass ☐ Fail ☐ N/A

Comments:

Signature of Inspector: _____ Date: _____

Americas

Drilling, Boring & Direct Push Probing

S3AM-321-PR1

1.0 Purpose and Scope

1.1 This document provides procedures designed to help prevent injuries to personnel working on the project and pedestrians, property damage, and adverse environmental impact as a result of potential hazards associated with drilling, boring and direct-push probing. These hazards include, but are not limited to, encountering underground utilities, subsurface installations, rotating equipment and potential overhead hazards.

1.2 This procedure provides the minimum requirements to be followed when drilling, boring, and probing work are performed.

1.3 This procedure applies to all Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

1.4 The Manager is responsible for meeting all the requirements in this procedure.

1.5 AECOM's clients may have specific procedures which shall be followed to identify and map utility and subsurface structures on their properties or facilities. Provided the client's procedures meet or exceed those of AECOM, approval shall be obtained from the Manager and the SH&E Manager to follow the client's procedures.

2.0 Terms and Definitions

2.1 **Underground Utilities –** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling, and communications, etc.

2.2 **Ground Disturbance (GD) –** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

2.3 **Intrusive Activities –** Examples: Excavation of soil borings, installations of monitoring wells, installation of soil gas sampling probes, excavation of test pits / trenches or other man-made cuts, cavity, trench, or depression in an earth surface formed by earth removal.

2.4 **Subsurface Installations –** Examples: Subterranean tunnels, underground parking garages, and other structures beneath the surface.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-118-PR1 Hearing Conservation

3.3 S3AM-208-PR1 Personal Protection Equipment

3.4 S3AM-209-PR1 Risk Assessment & Management

3.5 S3AM-213-PR1 Subcontractor Management

3.6 S3AM-305-PR1 Hand & Power Tools

3.7 S3AM-306-PR1 Highway and Road Work

3.8 S3AM-322-PR1 Overhead Lines

3.9 S3AM-322-FM1 Overhead Electrical Lines Acknowledgement

3.10 S3AM-325-PR1 Lockout Tagout

3.11 S3AM-326-PR1 Machine Guarding

3.12 S3AM-331-PR1 Underground Utilities

3.13 S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

- Confirm the development of the project SH&E Plan and compliance with this procedure.
- Confirm the appropriate equipment and materials are available to conduct the drilling, boring or direct-push operations.
- Confirm compliance with *S3AM-331-PR1 Underground Utilities.*
- Review the *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* prior to authorizing work to proceed.
- Confirm that employees conducting drilling, boring or direct-push probing possess any required training, registrations or certifications.
- Confirm all employees involved and affected by the task review the SH&E Plan, *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* and Task Hazard Assessment (THA) prior to work commencing.
- Confirm an equipment maintenance inventory is maintained, schedules adhered to and appropriate inspections of equipment are conducted.
- Provide authorization (with the concurrence of the Site Supervisor and SH&E Manager) for work to resume if interrupted due to unexpected conditions or events.

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

- Assist AECOM management as needed by providing guidance and clarification as to issues that may arise.
- Review the project SH&E Plan to confirm compliance with jurisdictional regulations**.** Provide technical guidance as needed when a variance is pursued related to this procedure. Confirm variance process meets requirements identified in *S2-001-SM1 Global SH&E Management System Manual*.

4.1.3 **Employees**

- Maintain training as appropriate to the work to be completed (e.g., ground disturbance, lockout tagout, equipment operation, etc.). Refer to *S3AM-003-PR1 SH&E Training.*
- Review the SH&E Plan, *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist* and Task Hazard Assessment (THA) prior to work commencing.
- As appropriate to the anticipated or encountered hazards and as addressed in the applicable planning documentation, utilize appropriate personal protective equipment (PPE) and applicable training, practices and operating procedures.
- Immediately notify the Manager of any unanticipated conditions or events. If assigned equipment, perform appropriate inspections and confirmations of maintenance and / or repairs.

4.2 Training

4.2.1 All on-site employees involved with drilling, boring, and direct-push probing shall be trained, at a minimum, in these procedures and in the procedures of *S3AM-331-PR1 Underground Utilities*.

4.2.2 All operators and assistants shall have the appropriate safety training based on the SH&E Training Matrix and any additional training assessments developed at the business group**,** and be versed in the equipment to be utilized.

- Refer to *S3AM-003-PR1 SH&E Training.*

- This training may include, but is not limited to, Excavation / Trenching (Ground Disturbance), HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.
- Only qualified personnel shall operate and inspect equipment.

4.2.3 All on-site Employees involved with drilling, boring, and direct-push probing activities shall be provided with on-site orientation of the drill rig and its operation.

4.2.4 All Employees involved with drilling, boring and direct-push probing activities at a client site shall receive the applicable client-required training**.**

4.3 Planning

4.3.1 SH&E Plan – At a minimum, a SH&E plan that includes a pre-job hazard assessment shall be prepared and communicated to all involved personnel prior to any drilling, boring, and direct-push probing activities. Refer to *S3AM-209-PR1 Risk Assessment & Management*.

- Assessment shall include both overhead and subsurface utilities and installations. Refer to *S3AM-322-PR1 Overhead Lines* and *S3AM-331-PR1 Underground Utilities*.
- The SH&E Plan will address any required environmental monitoring including gas monitoring, dust, noise, metals, radiation or other monitoring as may be appropriate for site conditions.
- All SH&E Plan requirements will be followed by the project team.
- The location specific emergency response plan shall be in place, contain procedures applicable to the potential emergencies presented by the operations, and be reviewed with all personnel potentially affected.

4.3.2 A Task Hazard Assessment (THA) shall be completed before every assigned task at the work location. The focus of the analysis shall be on the specific assigned task and the evaluation of risks and assignment of control measures based on actual work conditions.

4.3.3 *S3AM-321- ATT2 Pre-Drilling, Boring & Direct-Push Probing Flow Chart* summarizes the key Pre-Drilling, Boring, and Direct-push probing requirements addressed in this procedure.

4.3.4 Procedures and documentation as detailed in *S3AM-322-PR1 Overhead Lines* and *S3AM-331-PR1 Underground Utilities* shall be completed prior to any intrusive subsurface work.

- The locations of subsurface and overhead utilities and subsurface installations will be investigated, documented, mapped on a site plan and evidenced with appropriate surface markings.
- A site walk shall be conducted by the project team / site Manager and any other appropriate personnel, with the objectives of reviewing all planned intrusive activity locations, the locations of subsurface and overhead utilities and the potential for subsurface installations, to determine the appropriate utility clearance activities, and to observe other physical hazards.
- All proposed subsurface activities will be reviewed in comparison to subsurface and overhead utilities and subsurface installations and adjustments made as necessary.
- Appropriate clearance activities shall confirm location(s) of identified underground utilities and subsurface structures. Review the applicable completed *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist.*
- Site Walks should be repeated as necessary following the clearance of subsurface utilities and installations to confirm hazards are clearly identified.

4.3.5 Confirm drilling location(s) and / or bore entry and bore exit points are adequately identified on the worksite to enable appropriate equipment positioning.

4.4 Permits, Notifications and Access Agreements

4.4.1 Any required notifications shall be provided within the appropriate timeframe to the applicable organization (e.g. owner, agency, governing body, etc.).

4.4.2 All applicable permits (e.g. client, government, working near rail road, etc.) will be identified, obtained, and adhered to.

4.4.3 Access agreements will be obtained and adhered to as necessary.

4.5 Pre-Qualifying and Re-Qualifying Drilling Subcontractors

4.5.1 All drilling subcontractors will be properly pre-qualified in accordance with *S3AM-213-PR1 Subcontractor Management*.

4.5.2 The qualifications of the drilling crew performing the work will be evaluated prior to each mobilization and each day by AECOM's on-site representative to assure that their safety performance, training, qualifications, equipment, processes, and approaches reflect AECOM standards for excellence.

4.5.3 All drilling subcontractor equipment will be properly maintained and properly equipped, and the drilling subcontractor will verify their equipment is fully functional as a normal part of their daily and pre-work routine. Refer to *S3AM-321-FM1 Daily Drilling, Boring & Direct Push Equipment Inspection.*

4.6 General Health and Safety

4.6.1 Personal Protective Equipment – Refer to the *S3AM-208-PR1 Personal Protection Equipment* for best practices. These requirements may be modified or expanded in the SH&E Plan. Clothing shall be close fitting and comfortable without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the rig.

- Depending upon the hazards present, additional PPE may be required such as fire retardant clothing, specific hearing protection, respiratory protective equipment and chemical protective clothing.
- If the location has potential for underground electrical utilities to be present, workers shall ensure footwear has additional protection of shock resistant soles required (white rectangle with omega symbol).

4.6.2 Hearing Conservation – Hearing conservation program requirements may apply when working around operating equipment. Refer to *S3AM-118-PR1 Hearing Conservation*.

- Each worker shall wear noise-reducing ear protectors around operating equipment or during elevated noise levels. Distance from the elevated noise level is the primary measure of control for non-essential drilling personnel.

4.7 Drilling, Boring and Direct Push Equipment Maintenance and Inspections

4.7.1 All equipment will be inspected prior to the initiation of operations and daily during operations using the *S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection*. This inspection is the responsibility of the operator who will provide written documentation of the inspection prior to the start of drilling each day.

- Equipment that is deemed defective will immediately be repaired by a qualified person, or, if repair is not practicable, tagged "Out of Service" and sent for repairs or discarded.

4.7.2 Managers shall confirm an accurate inventory of the equipment within their operation requiring scheduled maintenance is developed. Using applicable regulations, industry standards, best practices, and manufacturer's recommendations, a maintenance schedule shall be developed with defined responsibility, required actions, and frequency. Refer to *S3AM-321-FM2 Drilling, Boring, & Direct-Push Equipment Maintenance Inventory.*

4.7.3 The maintenance program for equipment shall:

- Adhere to applicable regulations, standards, and manufacturers' specifications;
- Provide for service by appropriately qualified maintenance personnel; and,
- Require maintenance schedules and records of maintenance.

4.7.4 Employees or operators who are assigned equipment are required to review maintenance schedules for that equipment and will confirm that required maintenance has occurred or see that it is undertaken.

4.8 General Requirements

4.8.1 Excluding geoprobe activities, set up any sample tables and general work areas for employees at a safe distance from the rig.

- The recommended safe distance is the height of the fully extended mast plus 5 feet (1.5 meters), and no less than 30 feet (9.1 meters) from the rig.
- An increase to this distance may be required due to noise exposure hazards. Refer to *S3AM-118-PR1Hearing Conservation.*

4.8.2 Operation of the drilling, boring or direct-push equipment shall be restricted to the designated operator except to activate the emergency shut-off as required.

- All rotary drilling equipment shall have an emergency shut off / kill switch. The location of the switch and operation should be reviewed with all involved Employees.

4.8.3 Sit-on direct push rigs are not permitted on AECOM worksites unless the rig has been modified (in accordance with manufacturer's requirements) to be operated by remote control or the rig has been manufactured with a rollover protection system and seat belt.

4.8.4 Consult jurisdictional regulations as use of J-hooks and cat-heads may be prohibited. Examples:

- 29 CFR 1926 requires derricks and cranes to use hooks with self-closing latches and permits the use of J-hooks only for a task unrelated to this procedure (setting trusses).
- British Columbia and Saskatchewan prohibit the use of friction cat-heads**.**

4.9 Identifying the Work Area

4.9.1 Ensure the work area is adequately identified:

- Including zone around the drilling, boring, or direct push equipment, as well as fluid equipment, entry point, exit point and any excavated areas.
- Utilize barricades, signage, pylons, snow fence, etc. as appropriate.
- Implement traffic control as necessary.
- Coordinate with concurrent operations to identify their associated hazards and controls, and communicate those associated with AECOM tasks.

4.9.2 When operating near public vehicular and pedestrian traffic, the on-site personnel shall take every precaution necessary to see that the work zone is properly established, identified, and isolated from both moving traffic and passer-by pedestrians (refer to *S3AM-306-PR1 Highway and Road Work*).

4.9.3 All traffic control devices shall be installed, placed, and maintained in accordance with a Traffic Control Plan, client specifications, and / or the Manual of Uniform Traffic Control Devices and Manual of Uniform Traffic Control Devices for Canada in Canada. Traffic control devices shall consist of and not be limited to

- Directional and informational signage;
- High visibility barricades, cones, or barrels;
- Lighting; and
- Other equipment and devices as required.

4.10 Clearing Work Areas

4.10.1 In addition to any minimum requirements the drilling subcontractor may have, prior to set up, adequate site clearing and leveling shall be performed to accommodate the rig and supplies and provide a safe working area.

4.10.2 Clearing the site includes clearing the intended drilling area obstacles and of underground utilities in accordance with *S3AM-331-PR1 Underground Utilities*.

4.10.3 Drilling or probing shall not commence when tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

- The cleared / levelled area should be large enough to accommodate the rig and supplies.
- If the rig is positioned on a steep grade and levelling of the ground is impossible or impractical, the wheel of the transport vehicle shall be blocked and other means employed of preventing the rig from moving or toppling over.

4.11 Drilling Activities

4.11.1 Federal / State / Provincial / Territorial regulations that govern drill rig operations and exposed moving parts shall be adhered to.

4.11.2 All applicable client on-site safety procedures shall be understood and adhered to.

4.11.3 Minimum approach distances (MAD) from subsurface and overhead utilities and subsurface installations will be established including 5 feet (1.5 meters) from any subsurface utility, 7 feet (2.1 meters) from the pad surrounding any underground storage tanks, and 10 feet (3 meters) from any overhead energized electrical line (or further depending on line voltage). These approach distances are a minimum; government regulations and utility requirements may dictate a greater set back distance and should be confirmed.

4.11.4 Verify that equipment / energy is isolated when lockout is required:

- Refer to operator's manual and *S3AM-325-PR1 Lockout Tagout*.
- Ensure stop switch is activated.
- Driller is out of the seat.
- Test controls to ensure they do not engage.

4.11.5 In addition to any identified minimum requirements (as applicable, client, drilling subcontractor), the following safety measures shall be taken during drilling, boring or probing operations on site:

- The operator and helper shall be present during all active rig operations.
- Site personnel shall remain within visual contact of the rig operator.
- Hard hats, approved safety boots, safety glasses, and hearing protection shall be worn in the work zone (minimum, the radius around the rig equal to the height of the drill rig mast) of a rig.
- Gas monitoring shall be conducted as appropriate.
- Hands, feet and other body parts shall be kept away from moving parts, (e.g. hoisted, rotating, pushing, etc.) including augers, drill rods and reamers.
- When observing drilling, stand upwind of the drill rig to prevent potential exposure to vapors that may be emitted from the borehole.
- The emergency shut-off switch on the rig shall be identified to site personnel and tested on a daily basis by the operator.
- Unauthorized personnel shall be kept outside of the established work zone.
- Rig crew and other worksite personnel shall not use a cell phone while operating the drill rig or other equipment or within the rig work zone.
- Do not drive the rig from hole to hole with the mast (derrick) in the raised position.
- Before raising the mast (derrick) look up to check for overhead obstructions. Refer to *S3AM-322-PR1 Overhead Lines*.

- Before raising the mast (derrick), all rig personnel (with the exception of the operator) and visitors should be cleared from the areas immediately to the rear and the sides of the mast. All rig personnel and visitors should be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised and drilling is commenced, the drill rig shall be first levelled and stabilized with levelling jacks and / or solid cribbing.
    - The drill rig shall be releveled if it settles after initial set up.
    - Lower the mast (derrick) only when the levelling jacks are down, and do not raise the levelling jack pads until the mast (derrick) is lowered completely.
- After the rig has been positioned to begin drilling, all brakes and / or locks shall be set before drilling begins.
- The operator of a rig shall only operate a drill rig from the position of the controls. The rig shall not be in operation if the operator of the rig leaves the area of the controls.
- Throwing or dropping tools shall not be permitted. All tools shall be carefully passed by hand between personnel or a hoist line should be used.
- If it is necessary to operate the rig within an enclosed area, make certain that exhaust fumes are conducted out of the area.
    - Exhaust fumes can be toxic and some cannot be detected by smell.
    - Air monitoring and, as necessary, noise monitoring shall be conducted.
- Clean mud and grease from boots before mounting a rig platform and use hand holds and railings. Watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch any metal parts of the rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- All unattended bore holes shall be adequately covered or otherwise protected to prevent rig personnel, site visitors, or animals from stepping or falling into the hole. All open bore holes shall be covered, protected, or backfilled adequately and according to Federal / State / Provincial / Territorial or local regulations on completion of the drilling project.
- When using a ladder on a rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending and descending. Always use adequate fall protection and a full body harness when climbing above 6 feet (1.8 meters) of the ground. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool “bucket” or a safety hook to raise or lower hand tools.

4.12 Drilling Fluid

4.12.1 Ensure drilling fluid is appropriate to the soil type and conditions to be encountered to enable smooth drilling.

4.12.2 Drilling fluid used in the boring process shall be contained at the entry and, as applicable, exit locations until recycled or removed from the site.

4.12.3 Confirm drilling fluid does not enter roadways, streams, municipal storm or sanitary sewer lines, and / or any other drainage system or body of water.

4.12.4 Monitor drilling equipment and fluid equipment for any leakage or spills. Confirm appropriate containment is in place and adequate spill response supplies are available.

4.12.5 It is important to monitor fluid flow and pressure gauges when drilling with any tooling, but it is essential when drilling with a mud motor (pump placed in the drill string to provide additional power to the bit while drilling).

4.13 Unanticipated Concrete / Debris or Void

4.13.1 The presence of subsurface installations and utilities requires special care when obstructions / refusal and voids are encountered and when unexpected absence of soil recovery occurs during

drilling operations. Other indicators of subsurface installations and utilities are the presence of warning tape, pea gravel, sand, non-indigenous material, bentonite, red concrete (indicative of electrical duct banks) and any departure from native soil or backfill.

4.13.2 If unanticipated concrete / debris is encountered and / or if a void is encountered, drilling will be immediately discontinued and the Manager notified. Drilling may only proceed with Manager or SH&E Manager approval.

4.14 Use of Manual Slide Hammer

4.14.1 The following health and safety procedures should be followed when using a manual slide hammer to install shallow injection points, drive point piezometers, and drill tools:

- Only use a manual slide hammer that either attaches directly to the point / piezometer being driven or that incorporates a cap on the point / piezometer / drill tool that prevents the slide hammer from slipping off the point / piezometer / drill tool.
- Always grasp the manual slide hammer (handles if equipped with handles) with both hands while driving the point / piezometer / drill tool.
- Never allow hands or feet to get between the manual slide hammer and the drive plate or anvil.

4.15 Use of Augers

4.15.1 The following general health and safety procedures should be followed when supervising borings with continuous flight hollow-stem augers:

- Never place hands or fingers under the bottom of an auger section when it is being hoisted over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When augers are rotating, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Use a long-handled shovel to move auger cuttings away from a rotating auger. Never use hands or feet to move cuttings away from a rotating auger.
- Do not attempt to remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.
- Loud noises may occur while driving split spoons. At minimum hearing protection shall be worn when driving split spoons.
- When pulling / lifting augers, a clevis pin or other closed device shall be used. Use of J-hooks is prohibited.

4.16 Attaching and Breaking Rods

4.16.1 Do not use manual tools (e.g., pipe wrenches) in combination with rotation of the drill stem. Manual tools are not designed for the load, and may break.

- The use of such tools creates a significant impact hazard for those in the work area, because they rotate with the drill stem. Manual tool use in combination with a rotating drill stem to attach or break rods is therefore prohibited.
- Manual tools may be used if the drill stem is isolated / positively disengaged.
- Mechanical means of rod separation that are permitted include:
  - Opposing hydraulic controls.
  - Rod locking devices or machine's power vice.
  - Hydraulic breakout tools.
  - Hydraulic foot clamps.

4.16.2 Rod box changes present severe crushing hazards. Operators shall ensure all crew members are clear of the machine and hoisting equipment while they are changing rod boxes.

4.17 Rotary, Sonic and Core Drilling

4.17.1 In addition to the health and safety procedures identified above, the following general health and safety procedures should be followed when supervising borings with rotary, sonic and core drilling:

- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws. Drill rods should not be held or lowered into the hole with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently released into the hole, do not attempt to grab the falling rods with your hands or a wrench.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use hands to clean drilling fluids from drill rods.
- When drill rods are rotating, stay clear of the rotating components of the drill rig. Never reach behind or around a rotating drill rod for any reason.
- Use a long-handled shovel to move cuttings away from the top of the borehole. Never use hands or feet to move cuttings away from the borehole.
- If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Keep away from area where drill rods are being moved or raised to the rig. Do not stand in the area where a drill rod will fall or slide if it should be dropped.
- Loud noises may occur during drilling. Hearing protection shall be worn.

4.18 Direct-push

4.18.1 The following general health and safety procedures should be followed when supervising drilling borings with direct-push drilling:

- Loud noise may occur during direct-push drilling. Appropriate hearing protection shall be worn.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a suitable rod wiper. Do not use hands to clean drilling fluids from drill rods.
- If work shall progress over a portable drilling fluid (mud) pit, do not attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough-surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

4.19 Horizontal Directional Drilling

4.19.1 During surface to surface operations a 16.4’ (5 meters) safe zone shall be established and identified at both the entry and exit locations; no personnel are permitted to be within this zone unless the drill is locked out and the operator is out of the seat.

4.19.2 Machine shall be locked out before entering an excavation, changing tools, adding or removing drill stem or doing any other work on tools or the drill stem at the exit end of the bore.

4.19.3 A tracking head shall be installed on the drill stem:

4.19.4 Assemble drill head using components appropriate to the soil conditions to be encountered (e.g. nozzle, bit, beacon housing, etc.).

4.19.5 Ensure all personnel are clear of the bore entry point (outside of identified work zone).

4.19.6 At all times two way communication will be maintained at entrance and exit points using two way radios or equally effective communication means. If at any time communication is lost, all work will be stopped until communication is re-established

4.19.7 Locate drill head with tracking device at least every half-length of pipe. Adjust direction as necessary to follow the intended bore path.

4.19.8 Any drilling fluid returning to the surface shall be cleaned up promptly.

4.19.9 Drill pipe should exit the bore at an angle of 5 to 10° from the ground surface.

4.19.10 Turn off fluid flow as soon as drill head emerges.

4.19.11 Lockout machine and remove drill head using appropriate breakout tools.

4.19.12 Select and attach a reamer that allows the return of drilling fluids and cuttings, to reduce frictional pullback forces, and to allow for bend radius of the pipe. Reamer shall be:

- The smaller of 1.5 times the outside diameter (O.D.) or 12 inches (300mm) larger than the diameter of the product pipe.
- A diameter less than 1.5 times the diameter of the product may be necessary in collapsing soil formations.
- Reamed diameter may need to be increased by up to 25% if substantial swelling of the soil is expected to occur.

4.19.13 All personnel shall clear the trench or the designated surface zone (16.4 feet [5 meters]) once the reamer is attached. Operator shall only reverse lockout and commence pullback when communication is received from personnel on exit hole side and operator has confirmed the message.

4.19.14 Personnel on exit hole side shall ensure reamer is pulled the entire way back to the exit hole.

- If rotation is started when drill rod and reamer are away from the exit hole, very fast sideways movement of the rod and reamer can occur.
- Larger reamers and longer lengths of exposed drill rod increase the speed and distance of this movement.

4.19.15 If working with trailing drill stem, swivels shall be verified as lubricated and rotating freely by hand prior to use:

- A freely moving swivel prevents trailing drill stem or product from rotating / whipping.
- If the swivel does not move freely by hand it shall be removed from service and repaired or replaced.
- Only use swivels with limited articulation to prevent whipping or cranking action between the reamer and trailing drill pipe or product.

4.19.16 It is important to clean and lubricate the tool and drill stem joint threads before each use.

4.19.17 Any individual drill pipes that are bent or damaged shall be immediately taken out of service.

4.19.18 Occasionally change the order of the lead drill pipe (i.e. move the lead pipe to the end of the stem, or other pipe rotation procedures) to extend drill stem life.

4.19.19 Operator should avoid stalling the pipe rotation to avoid stress damage from shock loading.

4.20 Drilling at Potential MEC / UXO Sites

4.20.1 If the project site is suspected of containing munitions and explosives of concern (MEC) or unexploded ordnance (UXO), the UXO team will conduct a reconnaissance and MEC / UXO avoidance to provide clear access routes to each site before drilling crews enter the area. The following procedures will be implemented:

- Drilling operations on an MEC / UXO site will not be conducted until a complete plan for the site is prepared and approved by the AECOM UXO Safety Officer. MEC / UXO avoidance shall be conducted during drilling operations on known or suspect MEC / UXO sites.
- The UXO team will identify and distinctly mark the boundaries of a clear approach path for the drilling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No personnel will be allowed outside any marked boundary.
- If MEC / UXO is encountered on the ground surface, the UXO team will clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.
- The UXO team will conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of MEC / UXO that may be in the subsurface. If a magnetic anomaly is encountered, it will be assumed to be MEC / UXO, and the approach path will be diverted around the anomaly. UXO personnel only will operate the appropriate geophysical instrument and identify MEC / UXO.
- An incremental geophysical survey of the drill-hole location(s) will be initially accomplished by the UXO team using a hand auger to install a pilot hole. If MEC / UXO is encountered or an anomaly cannot be positively identified as inert material, Hazardous, Toxic, and Radioactive Waste (HTRW) sampling personnel will select a new drill-hole location.
- Once the surface of a drilling site has been cleared and a pilot hole established as described above, the drilling contractor will be notified that the site is available for subsurface drilling.

4.21 Movement and Transport of Drilling, Boring or Direct-Push Equipment

4.21.1 Personnel transporting equipment shall be properly licensed and shall operate the vehicle according to Federal / State / Provincial / Territorial, and local regulations. Refer to *S3AM-005-PR1 Driving* and *S3AM-320-PR1 Commercial Motor Vehicles*.

4.21.2 Confirm the traveling height (overhead clearance), width, length and weight of the equipment with the carrier. Identify highway and bridge load, width and overhead limits, to confirm these limits are not exceeded and with adequate margin.

4.21.3 Allow for overhang of any drilling, boring or direct-push equipment when cornering or approaching other vehicles or structures.

4.21.4 Be aware that the canopies of service stations and motels are often too low for equipment loaded on a trailer to clear

4.21.5 Watch for low hanging electrical lines, particularly at the entrances to drilling sites or restaurants, motels, other commercial sites.

4.21.6 Never travel on a street, road, or highway with any part of the drilling, boring or direct-push equipment in a raised or partially raised position.

4.21.7 Remove all ignition keys if rig is left unattended unless client requirements specify that the keys remain in the ignition switch at all times.

4.21.8 Before moving a rig on location, the operator shall do the following:

- To the extent practical, walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles.
- Check the brakes of the truck / carrier, especially if the terrain along the route of travel is rough or sloped.
- Discharge all passengers before moving on rough or steep terrain.

4.21.9 Engage the front axle (on 4x4, 6x6, etc., vehicles) before traversing rough or steep terrain

4.21.10 Driving drill rigs along the sides of hills or embankments should be avoided; however, if side-hill travel becomes necessary, the operator shall conservatively evaluate the ability of the rig to remain upright while on the hill or embankment. The possibility shall be considered that the presence of

drilling tools on the rig may reduce the ability of the rig to remain upright (raises the center of mass of the rig).

4.21.11 Logs, ditches, road curbs, and other long and horizontal obstacles should be approached and driven over squarely, not at an angle.

4.21.12 When close lateral or overhead clearance is encountered, or when backing up, the driver of the rig shall be guided by another person on the ground.

4.21.13 Loads on the drill rig and truck shall be properly stored while the truck is moving, and the mast shall be in the fully lowered position.

4.22 Loading and Unloading

4.22.1 Consult applicable manufacturer's recommendations for loading and unloading of the equipment.

4.22.2 Use ramps of adequate design that are solid and substantial enough to bear the weight of the rig with carrier, including tools.

4.22.3 Load and unload on level ground.

4.22.4 Use the assistance of someone on the ground as a guide.

4.22.5 Check the brakes on the rig carrier before approaching loading ramps.

4.22.6 Distribute the weight of the rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the height of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.

4.22.7 The rig and tools should be secured to the hauling vehicle with ties, chains, and / or load binders of adequate capacity.

5.0 Records

5.1 All employee training files shall be maintained in accordance with *S3AM-003PR1 SH&E Training*.

5.2 Completed inspections and maintenance inventories shall be maintained the site or project files.

6.0 Attachments

6.1 S3AM-321-ATT1 Core Drilling Machine

6.2 S3AM-321-ATT2 Pre-Drilling, Boring, & Direct-Push Probing Flow Chart

6.3 S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection

6.4 S3AM-321-FM2 Drilling, Boring & Direct-Push Equipment Maintenance Inventory

Americas

Overhead Lines & Obstructions

S3AM-322-PR1

1.0 Purpose and Scope

1.1 Provides the safe work requirements to be observed where overhead obstructions (e.g., cable trays, pipe racks, etc.), overhead utilities, or other lines are present at a work location, including, but not limited to electric power lines, electrical apparatus, or any energized (exposed or insulted) parts, communication wires, or any other overhead wire or cable.

1.2 This procedure applies to all AECOM Americas**-**based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

2.0 Terms and Definitions

2.1 **Arc Flash Hazard** – A dangerous condition associated with the possible release of energy caused by and electric arc. Arc flash is the light and heat produced from an electric arc supplied with sufficient electrical energy to cause substantial damage, harm, fire, or injury.

2.2 **Electrical Hazard** – A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

2.3 **Minimum Approach Distance (MAD)** – The MAD is the closest distance any employee or any part of the operating equipment is permitted to approach an energized or a grounded object.

2.4 **Qualified Person (Electrical Transmission and Distribution) –** A person trained and knowledgeable in the construction and operation of electrical transmission and distribution equipment or a specific work method, and has been trained to recognize and avoid electrical hazards that might be present with respect to that equipment or work method.

2.5 **Types of Overhead Lines / Obstructions (examples)**:

- Overhead electric power lines
- Structural cable supports
- Guy wires
- Cable television / communication lines
- Cable Trays
- Pipe Racks
- Low Clearance Overpasses

3.0 References

3.1 S3AM-004 PR1 Incident Reporting, Notifications & Investigation

3.2 S3AM-010-PR1 Emergency Response Planning

3.3 S3AM-209-PR1 Risk Assessment & Management

3.4 S3AM-302-PR1 Electrical Safety

3.5 S3AM-303-PR1 Excavation

4.0 Procedure

4.1 Roles & Responsibilities

4.1.1 **Manager**

- Identify conditions where overhead electric power lines and other overhead obstructions may be present and outline what is required in the SH&E Plan and Task Hazard Assessments. Refer to the *S3AM-209-PR1 Risk Assessment & Management*.
- Confirm electrical and communication lines, and as appropriate other overhead obstructions, are identified on all site and project drawings.
- Coordinate and communicate with overhead electrical line owner or operator to identify and implement appropriate control measures.
    - Provide adequate advance notification to the Overhead Electrical Line Owner / Operator to allow for insulation or isolation and grounding of the line(s) if required.
    - Confirm the Overhead Electrical Line Owner / Operator(s) are fully informed as to when the operations are to begin, end and when any location changes are planned if applicable.
- Confirm Employees are trained as required for the scope of work and associated hazards.
- Coordinate and communicate with subcontractors or employees working around overhead electric power lines and as applicable, other overhead obstructions.
- Confirm the *S3AM-322-FM1 Overhead Electric power lines Acknowledgement* is completed by concurrent operations working around overhead electric power lines on the worksite.

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

- Assist and support the Manager in planning and responding to concerns regarding the exposure to overhead electric power lines.

4.1.3 **Employees**

- Maintain current training required for the scope of work and associated hazards.
- Inform the Manager of location conditions that may expose risks to overhead electric power lines.
- Comply with established minimum approach distances.

4.2 Training

4.2.1 The Manager shall confirm all Employees are oriented to the SH&E Plan and Task Hazard Assessment (THA) process, in accordance with *S3AM-209-PR1 Risk Assessment & Management*.

4.2.2 Confirm training requirements were met prior to work starting.

-
- Employee orientation shall include the Location Specific Emergency Response Plan.
- Proof of training and orientation shall be documented and retained in the project files.

4.2.3 Managers shall confirm that each Employee has received training required for the scope of work and associated hazards in accordance with *S3AM-003-PR1 SH&E Training*.

4.2.4 Additional training requirements may include, but are not limited to:

- The limitations of an insulating link / device, proximity alarm, and range control (and similar) device, if used.

- Grounding and bonding procedures.
- Client specific requirements

4.3 General Requirements

4.3.1 The AECOM Manager or supervisor and employees shall perform a walk-thru of the work site and / or review of the work area / travel route to identify the overhead electric power lines and any other overhead obstructions that could be impacted by the work. Consider high profile equipment, equipment in transport, swing radius of equipment, potential for shifting loads, etc. AECOM personnel may be accompanied by other applicable personnel (e.g. client representatives, contractors operating concurrently, etc.).

4.3.2 The location or project specific SH&E Plan shall identify all overhead line hazards and provide suitable methods of elimination or control. All involved or affected workers shall review the SH&E Plan to confirm proper communication of the overhead line hazards and awareness of the control measures associated with their work.

4.3.3 Assess applicable factors such as, but not limited to:

- Scope of work (e.g. hoisting materials, excavation, grubbing, etc.).
- Transportation route.
- Hoisting, excavating, or other equipment to be operated.
- Height, placement, and reach of equipment.
- Equipment or material loading / unloading.
- Location(s) of electric power lines, communication lines, guy wires, etc.
- Worker training and experience.
- Soil or ground condition and environmental conditions.
- Interruptions to electrical services.
- Hazard to public.
- Use of ladders.
- Pipe and other conducting materials.
- Notification of electric utility owner.
- Changing conditions.
- Communication of all hazards to all workers including contractors, sub-contractors, and concurrent operations.

4.3.4 Task Hazards Assessments (THAs) shall be completed to record the hazards and control measures specific to the task, including those related to overhead line and obstructions hazards, prior to undertaking assigned tasks. THAs shall be reviewed and signed by all workers involved in the specific task.

4.3.5 Should adverse weather conditions cause the work associated with overhead lines to be unsafe, the activities shall be discontinued.

4.3.6 Managers or designated employees shall formally notify all concurrent operations, or any others who may not have had reason to review and sign the related SH&E Plan or THAs, of work that is to be done in the vicinity of overhead lines at distances less than 50 feet (15.25 meters), and for non-electrical obstructions, at distances less than 10 feet (3.05 meters) if appropriate to the obstruction’s potential hazards, and obtain the operator's assistance in protecting workers involved.

- Formal notification may be accomplished through a review of the SH&E Plan or THAs by the concurrent operator and associated personnel, as evidenced by signing the respective document's acknowledgement.
- Alternately, the concurrent operations may acknowledge having reviewed AECOM's procedures with a separate acknowledgment form. *S3AM-322-FM1 Overhead Electric Power Lines Acknowledgement Form* or equivalent may be used.
- Prior to equipment operation within 10 feet (3.05 meters) of non-electrical obstructions, as appropriate to potential hazards associated with the obstruction, the Owner/Operator should be contacted to obtain specific details regarding the obstruction such as piping or tray contents,

4.3.7 Overhead lines are presumed to be energized unless the Overhead Electrical Line Owner / Operator confirms that the overhead line has been, and continues to be de-energized and visibly grounded at the worksite.

4.3.8 Overhead lines are presumed to be uninsulated unless the Overhead Electrical Line Owner / Operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution confirms that a line is insulated.

4.3.9 Confirm accurate measurement of load heights, maximum equipment radius and height or reach of any other equipment that could potentially encroach on the safe limit of approach for the overhead electrical line,guy wires, or other applicable overhead obstructions.

- The height of all applicable overhead lines and obstructions that pose contact or encroachment potential shall be determined prior to work commencing.
- The height of electric power lines may only be determined by the client, utility company professional, or by using an approved electronic measuring device.
- Awareness shall be maintained for any elements that could affect clearance (e.g. snow pack, ice or snow weighing down lines, excessive heat causing sag, etc.).
- Caution shall be exercised when working or travelling near overhead lines having long spans, since they tend to be more prone to lateral swing in response to the wind and can present a contact hazard.
- All low hanging communication lines in close proximity to energized lines shall be clearly identified as *Encroaching on Energized Lines.*

4.3.10 Managers shall contact the overhead owner/operator (i.e. local utility company) if work is to be done or before equipment is operated within 50 feet (15.25 meters) of an energized overhead line, to determine the voltage of the overhead line and establish the appropriate MAD.

- All inquiries regarding electric utilities shall be made in writing and a written confirmation of the outage / isolation shall be received by the appropriate AECOM Manager prior to the start of the task that may impact the utility.

4.3.11 Until the voltage of the overhead electrical line is known and the MAD established, an exclusion zone shall be created at ground level beneath and 50 feet (15 meters) perpendicular to the overhead electric power lines on each side.

- The exclusion zone shall be demarcated with visual indicators (e.g., signage, flagging, paint, cones). No equipment shall enter the exclusion zone without approval from AECOM management.
- Unqualified employees shall maintain a safe clearance distance in accordance with the established MAD when working in an elevated position near energized overhead lines. For additional information associated with Qualified Employees refer to *S3AM-302-PR1 Electrical Safety*.

4.3.12 The Minimum Approach Distance (MAD) as it relates to Voltage varies from jurisdiction to jurisdiction. The MAD or the regulatory minimum distance requirements, whichever is more stringent, shall be maintained. The below chart shows the Phase-to-Phase voltage rating voltages in kilovolts and the MADs applicable to all AECOM operations:

Minimum Approach Distances (MAD)

Voltage Range (Kilovolts) (Phase-to-Phase)	Minimum Approach Distance (MAD) in Feet (Meters)
Personnel shall allow for equipment movement and electrical line swaying when establishing a M.A.D.	
0 – 50 KV	10 (3)
Over 50 – 200 KV	15 (5)
Over 200 – 350 KV	20 (6)
Over 350 – 500 KV	25 (8)
Over 500 – 750 KV	35 (11)
Over 750 – 1,000 KV	45 (14)
Note: This requirement shall apply except where client, local, or governmental regulations are more stringent.	

Source: American National Standards Institute, Publication B30.5.

4.3.13 An appropriate distance shall be kept between equipment, its occupants, their tools and energized overhead lines, electrical apparatus, or any energized parts.

4.3.14 These minimum approach distances do not apply to a load, equipment, or building that is transported under energized overhead power lines if the total height, including equipment transporting it, is less than 13.5 feet (4.15 meters).

- If the travelling equipment, including load, is over 4.15m (13.62ft) a transportation permit shall be acquired from the appropriate jurisdiction to travel on any public road or highway.
    - Consult local jurisdiction as some US states may use heights of up to 4.45m (14.6ft).
    - Notification of appropriate utility companies may be required in conjunction with the transportation permit. Jurisdictional requirements shall be verified prior to transport.
    - Route shall be checked for clearance of overhead electrical and communication lines prior to transport.
    - A designated signaler will be utilized when the height of the equipment, buildings, tractor / trailers or any other transport equipment travelling under an overhead electrical line is greater than 4.15m (13.62ft).

4.3.15 Employees shall not place earth or other material under or beside an electrical overhead line if doing so reduces the safe clearance to less than 50 feet (15.25 meters) or, if appropriate to potential hazards associated with other types of overhead obstruction, less than 10 feet (3.05 meters). To maintain a safe distance:

- Install warning devices and signs (hang a sign from and mark all guy wires to warn traffic of low clearance; provide warning signage for all overhead services).
- Install telescopic, nonconductive posts and flagging across right-of-way at the minimum allowable clearance as allowed by regulations for the line voltage.
- Position signs or other devices to determine the “Danger Zone”.

- Inform all job site personnel of the danger zone and the safe distances required.
- Beware of atmospheric conditions, such as temperature, humidity, and wind that may dictate more stringent safety procedures.

4.3.16 If employees are to climb or perform work on poles or towers, the structures shall be confirmed as capable of withstanding the weight and activity without failure.

4.3.17 If holes are dug for poles or foundations for structures, appropriate measures shall be taken to prevent inadvertent entry by personnel or equipment. Refer to *S3AM-303-PR1 Excavation*.

4.3.18 Operation of heavy equipment and cranes in areas with overhead lines represents a significant arc flash and electrical hazard to all personnel on the job site.

- Accidental contact with an energized overhead line or arcing between a high power line and grounded equipment, can cause harm to nearby equipment operators or ground personnel and damage to power transmission systems and / or operating equipment.
- Equipment will be repositioned and blocked so that no part, including cables, can come within the established minimum clearances.

4.3.19 Gravel trucks, cranes, boom trucks, etc. shall retract, stow and lower boxes, outriggers, booms, etc. to the travel position prior to entering municipal and client owned roads (e.g. leaving plant sites, work over rig sites, battery sites, and storage yards) and any time travel may put the equipment within the MAD of an electrical line.

4.3.20 When a signal person is required, the individual shall wear reflective striping (coveralls or vest) and carry an air horn or other appropriate means of emergency communication.

4.3.21 The signal person shall be aware of the potential electrical line hazards, be verified as competent by their supervisor and not have any other duties while acting as the signal person.

4.3.22 The signal person shall remain outside the MAD and in a position that allows for monitoring of equipment or loads to prevent encroachment on the MAD.

4.3.23 Signs, pylons, high visibility tape and / or signalers shall not be removed until the last piece of AECOM equipment has traveled under the overhead electrical line.

4.4 Minimum Approach Distance (MAD) Reduction

4.4.1 Where any work task will not allow the MAD to be maintained, an alternate means of protection shall be implemented by the Manager and approved by the SH&E Manager. In order of preference, acceptable procedures are:

- De-energize the overhead line(s) / lockout by local utility authorities; or
- Implement alternative procedures as identified by the Overhead Electrical Line Owner / Operator or a registered professional engineer.

4.4.2 De-energize Overhead Lines

- Elimination of electrical power provides the most acceptable means of ensuring safety of personnel. While temporary site overhead lines are often under the control of the site manager (and can be de-energized locally), electrical distribution and transmission lines can be de-energized only by the Overhead Electrical Line Owner / Operator. De-energizing of an overhead line often requires advance coordination with the Overhead Electrical Line Owner / Operator. At least one week advance notice should be provided.
- Managers shall confirm with the utility Overhead Electrical Line Owner / Operator that the overhead line has been de-energized and visibly grounded at the job site.

4.4.3 Alternative Procedures

- Managers may implement alternative procedures to prevent arc flash and electrical contact. These procedures shall be identified by the Overhead Electrical Line Owner / Operator or a registered Professional Engineer who is a Qualified Person with respect to electrical power transmission and distribution.
- A planning meeting with the Manager, SH&E Manager and the Overhead Electrical Line Owner / Operator (or registered Professional Engineer) shall be held to determine the most effective alternative procedures.
- Alternative procedures shall meet all client, local and governmental regulatory requirements.
- The work will be conducted by qualified and competent individuals, following the alternative written safe work procedures. All others are restricted from entering the MAD.
- Insulating Barriers shall be rated for the voltage line being guarded. These barriers may not be part of or attached to the equipment. The MAD shall only be reduced within the designed working dimensions of the insulating barrier. This determination shall be made by a Qualified Person in accordance with local or governmental requirements for work practices near energized equipment.
- Consult *S3AM-302-PR1 Electrical Safety* procedures to properly ground equipment and for limitations of grounding.
- Dedicated Line Spotters shall be trained to enable them to effectively perform their task, including training on the applicable local and governmental regulations.
- No work that encroaches on an energized power line will be completed outside of daylight hours.

4.5 Additional Safety Measures.

4.5.1 When equipment shall repeatedly travel beneath electric power lines, a route shall be plainly marked and “rider poles” of non-conductive material shall be erected on each side to confirm equipment structures are lowered into a safe position.

- 20” X 28” (50.8cm X 71.12cm) Danger Overhead Power Lines signs, which are highly visible, shall be erected at a height of 1.8 meters (6ft) on each side of the electrical line. A combination of pylons and high visibility tape shall be placed underneath the electrical line.
- These signs shall be in plain view of equipment traveling in either direction, but no closer than the MAD.
- If physical guards (i.e. goal posts, rider poles) are used, the guards shall be of non-conductive material and consist of a pole on each side of the approach connected by a rope.
- The poles will be placed at the MAD from and on each side of the electrical line. The ropes will be set at a height, which will maintain the MAD from the electrical line.

4.5.2 Watch for uneven ground that may cause vehicles and equipment to weave, bob, or bounce.

4.5.3 The following additional safety measures shall be implemented as needed when working around energized power lines:

- Provide equipment with proximity warning devices. These provide an audible alarm if any part of the equipment gets too close to a line.
- Install ground safety stops. These prevent vehicles from accidentally entering hazardous areas.
- Equip cranes with a boom-cage guard. This prevents the boom from becoming energized if an electrical line is contacted.

- Utilize insulated links and polypropylene tag lines. These prevent the transmission of electricity to loads or tag line handlers if an electrical line is contacted.

  NOTE: These additional safeguards are intended as supplemental protection. Use of these measures is not permissible as a substitute for maintaining the safe working distance or implementation of the procedures outlined in this document.

4.6 Emergency Planning

4.6.1 Managers shall complete a location specific emergency response plan as part of their location or project specific SH&E Plan for all operations during which equipment is operated within 50 feet (15.25 meters) of an energized overhead electrical line or conductor. Refer to *S3AM-010-PR1 Emergency Response Planning*. This plan shall identify the following information:

- The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.
- The safest means of evacuating from equipment that may be energized.
- The potentially energized zone around the equipment.
- The need for crew in the area to avoid approaching or touching the equipment and the load.
- The means to de-energize the electrical line or live conductor.
- The contact information for the utility Overhead Electrical Line Owner / Operator and emergency services.

4.6.2 In the event of an incident, the Employee shall report it in accordance with *S3AM-004 PR1 Incident Reporting, Notifications & Investigation.*

4.6.3 All damaged utilities shall be repaired by a qualified and / or licensed professional.

5.0 Records

5.1 Retain the Overhead Electric power lines Acknowledgement forms and any document related to requests of and confirmation from the Overhead Electrical Line Owner / Operator in the project files. Documentation of employee training completed shall be retained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

6.1 S3AM-322-FM1 Overhead Electric Power Lines Acknowledgement Form

Americas

Underground Utilities & Subsurface Installation Clearance Flow Chart

S3AM-331-PR1

Before Any Underground Utilities and Subsurface Installation Clearance

PERMITS AND ACCESS AGREEMENTS

- **Government and Utility/Infrastructure Permits**
- **Client permits and procedures**
- **Access Agreements**

KEY POINT: Obtain all permits and sign Access Agreement (if required)

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GENERAL HEALTH and SAFETY

KEY POINT: Prepare the SH&E Plan and a Task Hazard Assessment (THA).

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LOCATING UNDERGROUND UTILITIES & SUBSURFACE INSTALLATIONS

KEY POINT: Utilize the appropriate call/click-before-you-dig provider and as necessary, engage private locators. Refer to *S3AM-331-ATT1 One-Call System*.

↓

IDENTIFICATION & MAPPING OF UTILITY and SUBSURFACE STRUCTURES

KEY POINT: Generate a comprehensive site map illustrating known locations of overhead/subsurface utilities, subsurface structures, and proposed boring locations.
Complete *S3AM-331-FM1 Pre-Drilling, Boring, & Direct-Push Checklist*.

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SITE WALK

KEY POINT: Perform a site walk utilizing site map and 360° view to verify known conditions and identify potential issues. Add discovered items/issues to map for use in location confirmation.

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PROPOSED SUBSURFACE INVESTIGATION LOCATIONS

KEY POINT: Confirm that locations meet the minimum required set-back distances.

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UTILITY CLEARANCE INVESTIGATION LOCATION CONFIRMATION

KEY POINT: Locations shall be hand-cleared using non-destructive ground disturbance techniques and visually verified.

Americas

Underground Utilities

S3AM-331-PR1

1.0 Purpose and Scope

1.1 Provides procedures designed to help prevent injuries to personnel working on the location and pedestrians, property damage, and adverse environmental impact as a result of potential hazards associated with encountering underground utilities, subsurface installations, and potential overhead hazards.

1.2 Provides the minimum requirements to be followed for underground work (e.g., excavations, drilling, boring, and probing work) to ensure that underground installations, and subsurface structures, are identified properly before work commences.

1.3 This procedure applies to all Americas-based employees and operations and any other entity and its personnel contractually required to comply with this document's content.

1.4 The Manager is responsible for meeting all the requirements in this procedure.

1.5 AECOM's clients may have specific procedures which shall be followed to identify and map utility and subsurface structures on their properties or facilities. Provided the client's procedures meet or exceed those of AECOM, approval shall be obtained from the Manager and the SH&E Manager to follow the client's procedures.

2.0 Terms and Definitions

2.1 **Underground Utilities –** All utility systems located beneath grade level, including, but not limited to, gas, electrical, water, compressed air, sewage, signaling and communications, etc.

2.2 **Clearance** – includes the following:

- The positive locating of underground utilities or subsurface installations in or near the work area.
- A signed statement by an appropriate representative attesting to the location of underground utilities and/or the positive de-energizing (including lockout) and testing of electrical utilities.

2.3 **Ground Disturbance (GD) –** Any indentation, interruption, intrusion, excavation, construction, or other activity in the earth's surface as a result of work that results in the penetration of the ground.

2.4 **Hand Clearance / Tolerance Zone –** The area on either side of the locate marks of a utility that shall be maintained in order to expose the utility through the use of non-destructive ground disturbance techniques acceptable to the owner of the buried utility and applicable jurisdictional requirements. Visual exposure is required before mechanical excavation equipment may be used.

2.5 **Intrusive Activities –** Examples: Excavation of soil borings, installations of monitoring wells, installation of soil gas sampling probes, excavation of test pits/trenches or other man-made cuts, cavity, trench or depression in an earth surface formed by earth removal.

2.6 **Non-Destructive Ground Disturbance Technique –** A safe and acceptable excavation method that is used to visually expose an underground utility without causing damage. Non-destructive ground disturbance techniques may include, but are not limited to:

- Hand digging.
- Use of non-conductive tools.
- Hydro-vacuum.

2.7 **Subsurface Installation –** Examples: Subterranean tunnels, underground parking garages and other structures beneath the surface.

2.8 **Utility Strikes –** Unplanned contact with utilities resulting in damage to the utility or its protective coating.

3.0 References

3.1 S3AM-003-PR1 SH&E Training

3.2 S3AM-303-PR1 Excavation

3.3 S3AM-321-PR1 Drilling, Boring & Direct-Push Probing

4.0 Procedure

4.1 Roles and Responsibilities

4.1.1 **Manager**

- Administer this procedure and the development of the SH&E Plan.
- Confirm the appropriate equipment and materials are available to conduct the underground utility and/or subsurface installation clearance.
- Confirm all employees involved and affected by the task review the SH&E Plan and Task Hazard Assessment (THA) prior to work commencing
- Authorize work to proceed using the *S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist*.
- Confirm that employees conducting underground utilities and subsurface clearance processes possess all required training, registrations or certifications.
- Provide authorization (with the concurrence of the Site Supervisor and SH&E Manager) for work to resume if interrupted due to unexpected conditions or events.

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

- Assist AECOM management as needed by providing guidance and clarification as to issues that may arise.
- Review the SH&E Plan to confirm compliance with jurisdictional regulations. Provide technical guidance as needed when a variance is pursued related to this procedure.

4.1.3 **Employees**

- Maintain training as appropriate to the work to be completed (e.g. ground disturbance, lockout tagout, equipment operation, etc.). Refer to *S3AM-003-PR1 SH&E Training*.
- Review the SH&E Plan and Task Hazard Assessment (THA) prior to work commencing.
- As appropriate to the anticipated or encountered hazards and as addressed in the applicable planning documentation, utilize appropriate personal protective equipment (PPE) and applicable training, practices and operating procedures.
- Immediately notify the Manager of any unanticipated conditions or events. If assigned equipment, perform appropriate inspections and confirmations of maintenance and/or repairs.

4.2 Training

4.2.1 All on-site employees involved with the underground utility and subsurface identification and associated clearance process shall be trained, at a minimum, in these procedures.

4.2.2 Employees shall complete all required training associated with their tasks in accordance with the SH&E Training Matrix and any training assessments developed at the business group.

- Refer to *S3AM-003-PR1 SH&E Training.*
- This training may include, but is not limited to, Excavation / Trenching (Ground Disturbance), HAZWOPER, Petroleum Safety Training (or Construction Safety Training), and H2S Alive as appropriate.

4.2.3 As applicable, employees shall receive client-required training.

4.3 Planning

4.3.1 Health and Safety Plan – At a minimum, a SH&E Plan and task hazard assessments (THAs) shall be prepared prior to any underground utilities and subsurface installations clearance activities.

- The SH&E Plan will address any required environmental monitoring including gas monitoring, dust, noise, metals, radiation or other monitoring as may be appropriate for site conditions.
- Employees shall comply with all SH&E Plan requirements.
- The location specific emergency response plan shall be in place, contain procedures applicable to the potential emergencies presented by the operations, and be reviewed with all personnel potentially affected.

4.3.2 *S3AM-331-ATT2 Underground Utilities & Subsurface Installation Clearance Flow Chart* provides a summary of the key requirements addressed in this procedure.

4.3.3 Underground utilities and subsurface installations shall be investigated as being present, including the following, but not limited to:

- Steam, gas and electric.
- Sewer and water.
- Subterranean tunnels.
- Fibre optics (note: routine geophysical surveys will not identify fibre optic cables).
- Traffic control cables.

4.3.4 Location of underground utilities and subsurface installations will be confirmed by cross-referencing available information:

- Maps, as-built drawings and issued for construction (IFC) drawings.
- Plot plans, permits, crossing/encroachment agreements.
- One-Call information, locator and provided surveys.
- Private utility information, locator and provided surveys (e.g. ground penetrating radar (GPR), electromagnetic, etc.).
- Owner supplied documentation.
- Site walks.

4.3.5 As applicable, emergency shut-off locations of utilities shall be verified before work activities commence.

4.3.6 Jurisdictional, land owner, client and utility owner requirements shall be consulted to determine the minimum search zone dimensions and appropriate clearance distances.

4.3.7 As necessary and if possible, adjust locations of excavations or intrusive subsurface work away from subsurface utilities and installations

4.3.8 Prior to any excavation or intrusive subsurface work, the *S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist* shall be completed. The form shall be reviewed and signed by the Manager.

- If the answer to any question in Part 1 of the checklist is “No” or “N/A”, no ground disturbance may take place without review by the Manager, in consultation with SH&E Manager, of the circumstances related to the particular item. The Manager shall initial beside each “No” or “N/A” item to indicate review and authorization.

4.4 Permits, Notifications and Access Agreements

4.4.1 Any required notifications shall be provided within the appropriate timeframe to the applicable organization (e.g. owner, utility company, agency, governing body, etc.).

4.4.2 All applicable permits (e.g. client, government, working near rail road, etc.) will be identified, obtained, and adhered to.

4.4.3 All access agreements will be obtained and adhered to.

4.5 Locating Underground Utilities and Subsurface Installations

4.5.1 Utilize the appropriate call/click-before-you-dig provider. Refer to *S3AM-331-ATT1 One-Call System*.

4.5.2 Federal/State/Provincial/Territorial and other “One Call” providers shall be contacted at least two working days and no more than ten working days prior to commencing the ground disturbance. Jurisdictional requirements shall be consulted to verify the appropriate advance notice. (e.g. 24 hours, two full working days, three to ten business days, etc.).

4.5.3 If the location of proposed excavation or intrusive subsurface work cannot be clearly and adequately identified, the route and/or area of the proposed ground disturbance shall be identified using white flags, paint or stakes prior to the arrival of the locator. Consult jurisdictional requirements as white-lining may be a mandatory requirement on all ground disturbances.

4.5.4 One Call providers shall appropriately identify and mark the subsurface utilities or installations, or otherwise provide written notification they do not have any facilities near the proposed subsurface/intrusive locations.

4.5.5 Confirm all circuits were on during subsurface checks if the checks were for identifying energized lines (e.g. circuits on timers or light sensing switches).

4.5.6 Areas that have a high density of sub-surface facilities may require a secondary locate by another independent locator to verify locations identified by the first locator.

4.6 Private Utility Locating

4.6.1 One Call services may not be available in various non-urban locations. Private utility locating companies shall be utilized to identify and located any underground utilities or subsurface installations.

4.6.2 Be aware urban areas (e.g. city or town) may have subsurface installations (e.g. underground garages) and utilities (e.g. public water, sewer, and gas pipelines) that are not covered by one-call systems.

- These subsurface installations and utilities require additional investigation and diligence beyond the one-call system.
- Additional investigation and diligence beyond the one-call system is also recommended for non-urban areas.

4.6.3 In urban areas, private utility locating companies shall be called to identify and locate, through geophysical surveys and other means, the presence of private utilities installed by the property owner (e.g. irrigation systems) and to verify the presence of public utilities on the properties.

- Hand clearance / tolerance zones shall be observed in urban areas and utilities exposed through the use of non-destructive techniques in accordance with requirements of the applicable jurisdiction and utility owner.

4.6.4 Observance of hand clearance / tolerance zones and utility exposure using non-destructive techniques is also recommended for non-urban areas and may be required by the applicable jurisdiction.

4.6.5 Warning tape, pea gravel, sand, non-indigenous material, bentonite, red concrete (indicative of electrical duct banks) and any departure from native soil or backfill may be evidence of the presence of subsurface installations and utilities.

4.7 Surface Markings

4.7.1 Once the underground installation has been identified, proper surface markings shall be made in accordance with the guidelines from the One-Call System (refer to S3AM-331-ATT1), guidance contained in this procedure or as contract-specified.

4.7.2 Color-coded surface marks (paints or similar coatings) shall be used to indicate the type, location, and route of buried installations. Additionally, to increase visibility, color-coded vertical markers (temporary stakes or flags) shall supplement surface marks.

4.7.3 All marks and markers shall indicate the name, initials, or logo of the company that owns or operates the installation and the width of the installation if it is greater than 2 inches.

4.7.4 If the surface over the buried installation is to be removed, supplemental offset marking shall be used. Offset markings shall be on a uniform alignment and shall clearly indicate that the actual installation is a specific distance away.

4.7.5 Locate marks shall be re-verified as per jurisdictional requirements or no later than 14 days after the previous locate was completed, whichever interval is shorter. These locate time intervals shall be maintained for the duration of the ground disturbance.

- If the work is interrupted during the determined lifespan or work does not commence during the applicable lifespan, a new locate shall be performed.
- Jurisdictional provisions may allow for an extension to the lifespan of the locate marks, however certain conditions may need to be met. (e.g. activities uninterrupted)
- If locate marks are moved or destroyed the location of the buried facilities shall be re-established.

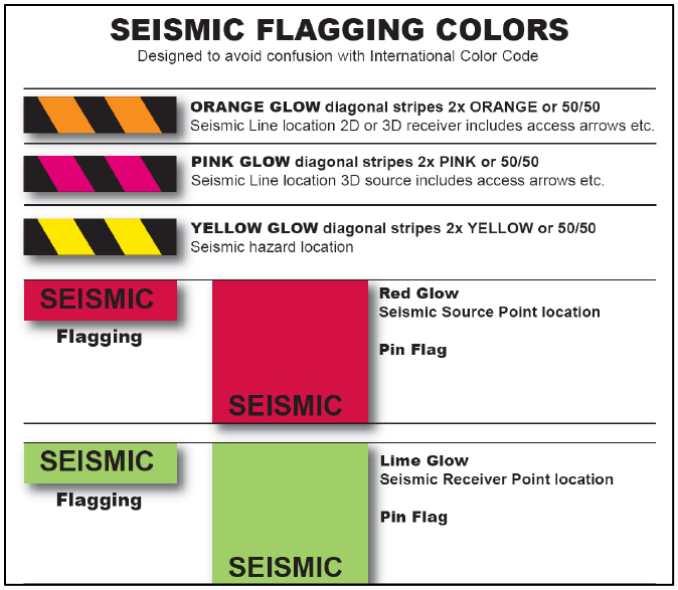
4.8 Uniform Color Coding

4.8.1 The colors and corresponding installation type are as follows unless otherwise contract-specified:

AMERICAN PUBLIC WORKS ASSOCIATION – APWA
Color Coding for Marking of Buried Facilities

White	Proposed Ground Disturbance Area
Pink	Temporary Survey Markings
Red	Electric Power Lines, Cables, Conduit and Lighting Cables
Yellow	Gas, Oil, Steam, Petroleum Lines or Gaseous Materials
Orange	Conduit, Cable, Communication, Alarm or Signal Lines
Blue	Potable Water
Green	Sewer, Storm Sewer and Drain Lines
Purple	Reclaimed Water, Irrigation and Slurry Lines (non-potable)

Canadian Association of Geophysical Contractors



4.9 Identification and Mapping of Utility and Subsurface Structures

4.9.1 The locations of subsurface utilities and subsurface installations shall be investigated, documented, and shown on a site plan (a scaled site plan shall be used when feasible). Refer to *S3AM-331-FM1 Underground Utilities & Subsurface Installation Clearance Checklist.*

4.9.2 Documentation of utility and subsurface installation identification (calling one call, responses from utilities) along with the scaled site plan shall be available on the worksite at all times of intrusive activities.

4.10 Site Walk

4.10.1 A site walk shall be conducted by the AECOM Manager and any other appropriate personnel with the objectives of reviewing all planned intrusive activity locations, the locations of subsurface and overhead utilities, overhead obstructions, and the potential for subsurface installations, to determine the appropriate utility clearance activities, and to observe other physical hazards.

- Walk the area at least 50 feet (15.2 meters) from perimeter of the site to observe physical hazards.
- Walk the area of at least 50 feet (15.2 meters) radius from each proposed subsurface intrusion location.
- If possible, particularly at urban and industrial sites, the client/property owner or an individual knowledgeable about the site and site utilities will attend the site walk.
- Add discovered items/issues to map for use in location confirmation.

4.10.2 The Site Walk further supplements the Identification and Mapping of Utility and Subsurface Structures procedure. Site Walks should be repeated as necessary following the Identification and Mapping of Utility and Subsurface Structures as visual verification of the hazards. Examples include:

- Proposed location(s) does not lie on a line connecting two similar manhole covers (e.g. sanitary sewer or storm drain).
- Proposed subsurface location(s) has not subsided, been excavated and patched, nor gives the appearance it may be covering a former trench (e.g. linear cracks, sagging curbs, linear re-pavements, etc.).
- Proposed subsurface location(s) does not lie on a line with any water, gas, electrical meters, utility cleanouts, or other utility boxes in the surrounding areas.

4.11 Proposed Subsurface Investigation Locations

4.11.1 All proposed subsurface locations will be reviewed in comparison to subsurface and overhead utilities and subsurface installations and adjustments made as necessary.

4.11.2 Minimum set back distances from subsurface and overhead utilities and subsurface installations will be established including 5 feet (1.5 meters) from any subsurface utility, 7 feet (2.1 meters) from the pad surrounding any underground storage tanks, and 10 feet (3 meters) from any overhead energized electrical line (or further depending on line voltage). These set back distances are a minimum; government regulations and utility requirements may dictate a greater set back distance.

4.12 Utility Clearance Investigation Location Confirmation

4.12.1 As applicable, all client on-site safety procedures shall be understood and adhered to.

4.12.2 Hand exposure or non-destructive ground disturbance techniques to expose an underground utility or subsurface installation are necessary to accurately determine size, location and alignment prior to mechanical excavation or intrusive subsurface work in the vicinity of that utility or installation.

4.12.3 Non-destructive ground disturbance techniques shall be acceptable to the owner of the buried utility (i.e. hydro-vacuum temperature or pressure).

4.12.4 Hydro-vacuum or air-knife require proper grounding equipment at sites where the subsurface may contain flammable gases, liquids, or vapors

4.12.5 Jurisdictional, land owner, client and utility owner requirements shall be consulted to determine the distance of the hand exposure zone, and what requirements, when met, may allow mechanical excavation within these zones.

4.12.6 At a minimum, all underground utilities and subsurface installations within a 5 feet (1.5 meter) radius of the work site shall be identified and physically located (seen) before use of mechanical excavation equipment is permitted. Jurisdictional, client, land owner and utility owner requirements shall be consulted as the required hand exposure radius may be larger.

4.12.7 In urban areas, proposed subsurface locations will be cleared by hand / non-destructive technique to 5 feet (1.5 meters) (soil borings and wells) or 12 inches (30 centimeters) (soil gas sampling probes) using non-mechanical methods.

- In non-urban areas, clearing by hand / non-destructive technique should be conducted if possible and shall be conducted as required by the given jurisdiction.
- Hand / non-destructive technique clearance should be extended if locations of deep utilities and structures are not known.
- Hand exposure or non-destructive ground disturbance techniques should extend a minimum of 24 inches (60 centimeters) below the intended ground disturbance depth to minimize the hazard of mechanical equipment contact with any utility or installation.

4.12.8 Mechanical equipment and attachment dimensions shall be considered when establishing the zone in which all underground utilities and subsurface installations are physically located (seen) prior to the use of that equipment. The radius may require expanding to maintain safe distances when using large equipment.

4.13 Utility Strikes

4.13.1 Utility strikes shall be reported in accordance with *S3AM-004-PR1 Incident Reporting, Notifications & Investigation*.

4.13.2 All damaged utilities shall be repaired by a qualified and/or licensed professional.

5.0 Records

5.1 Retain completed *S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist* and documents related the clearance process (e.g. Utility Owner communication, etc.) in the site or project files.

5.2 Documentation of employee training completed shall be retained in accordance with *S3AM-003-PR1 SH&E Training*.

6.0 Attachments

6.1 S3AM-331-ATT1 One-Call System

6.2 S3AM-331-ATT2 Underground Utilities & Subsurface Installation Flow Chart

6.3 S3AM-331-FM1 Underground Utility & Subsurface Installation Clearance Checklist

Americas

Concrete

S3AM-338-PR1

1.0 Purpose and Scope

1.1 The purpose of this procedure is to confirm the safety of AECOM Americas personnel during the installation of concrete forms, pouring of new concrete structures, or installation of preformed concrete structures.

1.2 This procedure applies to AECOM Americas employees and any other entity and its personnel contractually required to comply with this document's content where concrete is poured or handled. This procedure also applies to Portland cement, mortar, stucco, and other applications of cementitious products.

2.0 Definitions

2.1 None

3.0 References

3.1 S3AM-208-PR Personal Protect Equipment

3.2 S3AM 304 PR1 Fall Protection

4.0 Procedure

4.1 Implementation of this procedure is the responsibility of the manager directing activities of the facility, site, or project location.

4.2 General

4.2.1 Employees working above any adjacent working surfaces shall review and conform to the applicable fall protection requirements listed in *S3AM 304 PR1 Fall Protection*.

4.2.2 No employees will be permitted to work above an impalement hazard (e.g., rebar) unless it has been protected to eliminate the hazard of impalement.

4.2.3 Prohibit riding of concrete buckets for any purpose. Keep vibrator crews out from under concrete buckets suspended from cranes or cableways.

4.2.4 Provide an employee with a whistle or other sound-producing device to watch for approaching buckets and warn employees to stand clear while the concrete is dumped.

4.2.5 Where practical, use tag lines to control and position suspended concrete buckets.

4.2.6 Provide PumpCrete™ or similar systems using discharge pipes with pipe supports designed for 100 percent overload. Provide compressed-air hoses in such systems with positive fail-safe joint connectors, or otherwise secure them to prevent separation of sections when pressurized.

4.2.7 All nozzle men applying cement, air, sand and water through a pneumatic or high-pressure hose shall wear protective head, hand, and face equipment.

4.2.8 All concrete workers shall wear protective clothing, including safety glasses; rubber boots, and gloves, to reduce the danger of concrete burns. Refer to *S3AM-208-PR Personal Protection Equipment* for additional information.

4.2.9 Wear appropriate personal protective equipment when using tools and equipment associated with concrete masonry work.

4.2.10 Finishers shall wear safety glasses and face shields when chipping, wire brushing, or using power-impact or rotary tools in patching concrete.

4.2.11 In the pour area, or any area where dry Portland cement is being handled or mixed with water or

aggregate, provide means to flush eyes (e.g., eyewash station, bottles) for 15 minutes. If the material contacts skin, wash skin with water and ph-neutral soap or mild detergent.

4.2.12 Provide temporary winter protection enclosures with adequate ventilation, lighting, and fire protection.

4.2.13 Equip pavers with a loud warning bell or horn that sounds when a paver moves ahead or the bucket is run out.

4.2.14 Provide conical or tapered bottoms with mechanical or pneumatic means of starting the flow of materials for bulk storage bins, containers, or silos.

4.2.15 Construct handles on bull floats used where they may contact energized electrical conductors of nonconductive material, or insulate with a nonconductive sheath whose electrical and mechanical characteristics provide the equivalent protection of a handle constructed of nonconductive material.

4.2.16 Do not extend handles of buggies beyond the wheels on either side of the buggy. Installation of knuckle guards on buggy handles is recommended.

4.2.17 Provide concrete buckets equipped with hydraulic or pneumatically operated gates with positive safety latches or similar safety devices installed to prevent premature or accidental dumping. The buckets will be designed to prevent excess aggregate and loose material from accumulating excessively on the top and sides of the bucket.

4.2.18 Block the wheels of ready-mix trucks and set the brakes to prevent movement when discharging on a slope.

4.2.19 Properly guard exposed gears, chains, and rollers of mixers.

4.2.20 Secure sections and ends of tremies, elephant trunks, and similar concrete conveyances with wire rope, chain, or similar safe fastener.

4.2.21 Equip powered and rotating-type concrete troweling machines that are manually guided with a control or dead-man switch that will automatically shut off the power whenever the operator removes his hands from the equipment handles.

4.2.22 The use of ready-mix concrete trucks may create traffic problems, which proper planning and care can lessen and/or eliminate. Control backing operations through the use of a properly trained and attired flag person/spotter who will be positioned so that they have a clear view of the area behind the truck, as well as be clearly visible to the truck driver. Route movement of personnel and project equipment away from this area so that they do not have to cross the truck's means of egress.

4.3 Forms and Shoring

4.3.1 The completed shoring setup should be a homogenous unit or units. For example, do not use tubular steel shoring in combination with adjustable wood or jack-type shoring.

4.3.2 Confirm that formwork and shoring are be designed, erected, supported, braced, and maintained so that they will safely support all vertical and lateral loads that may be imposed upon them during placement of concrete.

4.3.3 Confirm that drawings or plans showing the jack layout, formwork, shoring, working decks, and scaffolding are available at the jobsite.

4.3.4 Remove and stockpile stripped forms and shoring promptly after stripping in all areas in which persons are required to work or pass. Remove and dispose of adhered concrete from forms and planking before stacking when possible to prevent generation of concrete dust. Pull, cut, or remove by other means any protruding nails, wire ties, and other form accessories not necessary to subsequent work to eliminate the hazard.

4.3.5 Do not impose any construction loads on the partially completed structure unless such loading has been considered in the design and approved by the engineer-architect.

4.3.6 When temporary storage of reinforcing rods, material, or equipment on top of formwork becomes

necessary, strengthen these areas to meet the intended loads.

4.3.7 Provide sills for shoring that are sound, rigid, and capable of carrying the maximum intended load.

4.3.8 Inspect all shoring equipment prior to erection to determine that it is as specified in the shoring layout. Do not use any equipment for shoring that is found to be damaged.

4.3.9 Inspect erected shoring equipment immediately prior to, during, and immediately after the placement of concrete. Immediately reinforce or re-shore any shoring equipment that is found to be damaged or weakened.

4.3.10 Provide re-shoring when necessary to safely support slabs and beams after stripping, or where such members are subjected to superimposed loads due to construction work done.

4.3.11 Build shoring or form systems in accordance with the AECOM procedure governing excavation when working in excavations.

4.4 Tube and Coupler Shoring

4.4.1 Use tubular steel frames for shoring layouts in accordance with each manufacturer's recommended safe working load based on tests conducted according to the "Recommended Procedure for Compression Testing Scaffolds and Shores" by the Scaffolding and Shoring Institute.

4.4.2 Prior to erection of steel frame shoring, conduct a thorough inspection to confirm material is not heavily rusted, bent, dented, or otherwise damaged or defective.

4.4.3 Provide final adjustment of adjustment screws prior to placement of concrete. Keep screw extensions to a minimum for maximum load carrying capacity.

4.4.4 Plan, design and construct any form, regardless of size, with an adequate factor of safety.

4.4.5 Do not use couplers (clamps) if they are deformed, broken, have defective or missing threads on bolts, or other defects.

4.4.6 Use material for the coupler (clamps) that is of a structural type such as drop forged steel, malleable iron, or structural grade aluminum. Do not use gray cast iron.

4.4.7 When checking the erected shoring towers with the shoring layout, confirm that the spacing between posts does not exceed that shown on the layout; check all interlocking of tubular members and tightness of couplings.

4.4.8 Confirm that all base plates, shore heads, extension devices, or adjustment screws are in firm contact with the footing sill and the form material, and are snug against the posts.

4.5 Vertical Slip Forms

4.5.1 Confirm that the steel rods or pipe on which the jacks climb or by which the forms are lifted are designed specifically for that purpose. Brace any rods not encased in concrete.

4.5.2 Position jacks and vertical supports in such a manner that the vertical loads are distributed equally and do not exceed the capacity of the jacks.

4.5.3 Provide the jacks or other lifting devices with mechanical dogs or other automatic holding devices to provide protection in case of failure of the power supply or the lifting mechanism.

4.5.4 Lift steadily and uniformly, and do not exceed the predetermined safe rate of lift.

4.5.5 Provide lateral and diagonal bracing of the forms to prevent excessive distortion of the structure during the jacking operation.

4.5.6 During jacking operations, the form structure shall be maintained in line and plumb.

4.5.7 Provide all vertical lift forms with scaffolding or work platforms completely encircling the area of placement.

4.6 Pre-Stressed and Post-Stressed Concrete

4.6.1 Keep tools and strand devices clean and in good repair to prevent failure.

4.6.2 Do not permit employees to stand in line or directly over the jacking equipment during tensioning operations. Provide signs and barriers to prevent employees from working behind the jack. Shield all jacking equipment and attachment pieces to protect the workers performing the stressing operations.

4.6.3 Carefully stack stressed members on a level base.

4.6.4 Pre-stressed girders and beams are often unstable when tipped; brace during transportation and handle in such a way to keep the member upright.

4.6.5 Handle stressed members at pick points specifically designated on the manufacturer's drawings, and with the lifting devices recommended by the manufacturer or the engineer in charge.

4.6.6 Do not allow personnel under stressed members during lifting and erection.

4.6.7 Keep anchor(s) turned up close to the anchor plate during jacking operations of any tensioning element(s).

4.6.8 Frequently inspect pulling heads, bolts, and hydraulic rams for indication of fatigue, and the threads on bolts and nuts for diminishing cross section.

4.7 Pre-Cast Concrete and Tilt-Up Operations

4.7.1 Do not permit employees under pre-cast walls, panels, or sections while they are being lifted or tilted into position.

4.7.2 Use properly attached tag lines, especially if the load is to be lifted and moved into place.

4.7.3 Adequately brace pre-cast walls or vertical concrete panels during construction.

4.7.4 Securely attach braces or shores to the concrete member.

4.7.5 Confirm lifting inserts on or in tilt-up pre-cast concrete members are capable of supporting at least two (2) times the maximum intended load applied or transmitted to them.

4.7.6 Confirm lifting hardware can support at least five (5) times the maximum intended load applied or transmitted to the lifting hardware.

4.8 Masonry Work

4.8.1 Handle and store masonry building materials in accordance with AECOM procedures for material handling; scaffolds for masonry construction shall be built in accordance with the AECOM procedures for scaffolding.

4.8.2 Equip power saws for cutting brick or stone with dust collectors or wet cutting methods to control dust. The exhausted dust will be directed away from vehicle or personnel traffic. If brick, stone, or mortar contains more than 1 percent crystalline silica, respirators may be required until air sampling determines that the task does not constitute a potential respiratory hazard.

4.8.3 Employees cutting brick or stone shall wear approved safety goggles or face shields over safety glasses, and hearing protection as appropriate for the task noise levels.

4.8.4 Keep mortar tubs free from ragged edges that may cut the hands, legs, and arms of bricklayers.

4.8.5 Properly brace all walls or vertical surfaces during construction to withstand wind and other pressure.

4.8.6 Dried mortar will not be dropped from planks, crushed by vehicles, or otherwise handled in such a manner as to create a dust hazard.

4.8.7 Masons and other workers with dusty clothes shall remove their outer clothing or otherwise remove masonry-generated dust from their clothes prior to leaving the work area for breaks or end of work. Do not use high-pressure air to remove dust.

5.0 Records

5.1 The following documentation will be maintained.

5.1.1 Training of flagmen/spotters

5.1.2 Inspections of shoring equipment

5.1.3 Air sampling logs for crystalline silica, as needed

6.0 Attachments

6.1 S3AM-338-ATT1 Concrete Products Health Effects

Heat-Related Illness Prevention

Site/Project Name
Location

Month and Year prepared

DELETE BEFORE FINALIZING: This is a template intended to provide guidance for the development of site specific Heat Illness Prevention Plans required by the 2015 update to 8 CCR 3395) and should be modified to support site specific operations. This plan is intended to work in conjunction with a Health and Safety Plan (HASP), Safe Work Plan (SWP) or Task Hazard Analysis with an Emergency Action Plan.

Risk for a heat-related illness varies based upon work activities, personal protective equipment (PPE)/clothing selection, geographical locations, personal conditions and weather conditions. To reduce the potential of developing a heat-related illness, AECOM has developed a site-specific procedure incorporating:

- AECOM's SH&E Procedure for Heat Illness Preventions (S3AM-113_PR_Heat Stress),
- California Occupational Safety and Health Administration Heat Illness Prevention Standard (Title 8 of the California Code of Regulations, Section 3395), and
- INSERT SWP, HASP, THA or supporting document

1. Planning

This section may be replaced with an actual forecast or historic data related to location/seasonal temperatures.

The Site Safety Officer (SSO) and Field Supervisor shall verify the risk of heat-related illnesses based on:

- Weather forecasts,
- Planned work activities,
- Planned PPE, and
- Personal risk factors.

The SSO and Project Manager shall also ensure the appropriate equipment and resources are available to employees at risk of a heat- related illness. Examples of necessary equipment may include (but are not limited to):

- Potable water with replenishment supply;
- Drinking cups, insulated water bottles or other small sealable container;
- Sun protection (hats, long sleeves, sunscreen, sunglasses);
- Communication method (cell phone or similar);
- Shade;
- Reliable thermometer (a simple thermometer, like those available at hardware stores, can be used to measure the outdoor "dry bulb" temperature); and
- Cooling devices such as cooling vests or misters.

INSERT HISTORICAL WEATHER DATA OR FORECASTED CONDITIONS FOR DURATION OF PROJECT.

2. Water

2.1 Provision of Water

Employees shall have access to potable drinking water. The frequent drinking of water shall be encouraged by supervisors and field team members.

- Each employee shall be provided with a minimum 2 gallons of water per 8-hour shift, free of charge.

- All water shall be fresh, pure, potable, and cool (cooler than ambient temperature).
- Water will be located as close as possible to the work area.
- Water will be stored in an environment that will ensure a cool temperature and prevent contamination.
- Replenishment Procedures:

Update this section with site specific water replenishment procedures.

  - **Fixed Site:** Replenishment water supply shall be located XXXXXXX. Employees will have access to replenishment during working hours and may be/are required to report the date, time and quantity of water taken from the replenishment supply.
  - **Mobile/Remote Work**: Mobile and remote employees may carry water bottles or smaller sealed container of water with them while they are working, and refill containers at the primary source (cooler or other designated source) during breaks or as needed.

    Containers and refill frequency shall provide for a minimum of 1 quart of water to be consumed per hour while working Water bottles or smaller sealed container do not need to be empty prior to refilling; water should always be immediately available to employees.

2.2 Dehydration Prevention

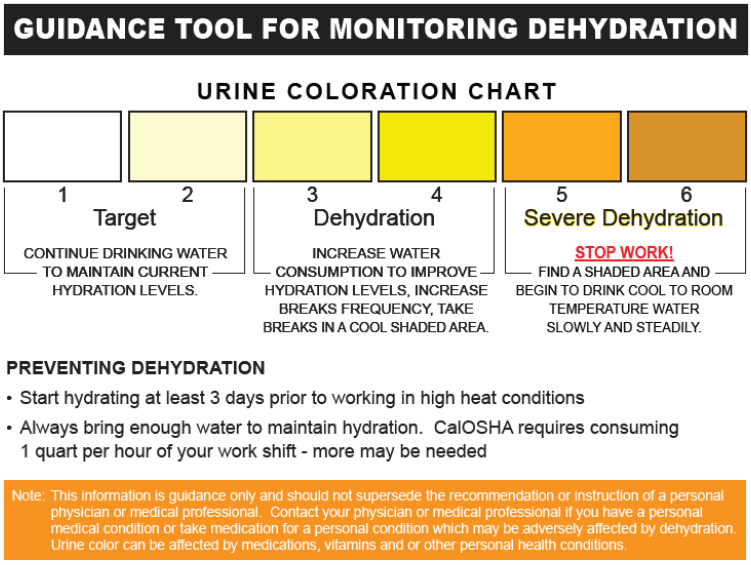
The 2006 Cal/OSHA Heat Illness Case Study showed that, although 90% of the worksites had drinking water at the site, 96% of the employees suffering from heat illnesses were dehydrated.

Dehydration occurs when the body loses too much fluid. This can happen when an employee stops drinking water and can be accelerated by work in hot or dry conditions. Not drinking enough fluids can cause muscle cramps, fainting and shock, which is a life-threatening condition.

Drinking water should increase with activity level. Dehydration can affect the body's ability to recognize thirst, so employees shall drink water on a time schedule.

In hot conditions, it is important that employees drink enough water that urination is required at least every 2 hours. Water is the best hydration fluid. If sports drinks are used, they should be diluted at least 50 percent with water prior to drinking. **Do Not Drink Distilled Water.**

Dehydration can be prevented by monitoring urine color and adjusting water intake accordingly. The following guidance was developed to aid employees in monitoring hydration levels. This tool can be downloaded from: Hydration Chart.



3. Access to Shade

This section may be replaced with a site-specific description of shade structures, locations. A map of these resources can also be included.

When temperatures **do not exceed 80 degrees Fahrenheit (°F) (26°Celsius [°C])**, access to shade for employee will be provided as needed, or as requested by employees. Timely access to shade will be provided upon an employee's request.

Shade is required when the temperature exceeds 80°F (26°C).

One or more shaded areas will be established at all times. Shade may require relocation to accommodate a moving work location.

The shaded area will either open to the air or be provided with ventilation or cooling (such as an air-conditioned vehicle). The amount of shade present shall be at least enough to accommodate the number of employees on a rest/recovery/meal/break period at any given time, so that they can sit in a normal posture fully in the shade without having to be in physical contact with each other.

The shaded area shall be located as close as practicable to the areas where employees are working, but no more than a 2.5-minute walk away. Access must be undeterred (free from obstacles or other barriers such as crossing traffic). The shaded area will be away from portable toilets, and in a clean, dry and otherwise hazard-free environment.

Examples of appropriate access to shade:

- Buildings, canopies, lean-tos, or other partial or temporary structures that are either ventilated or open to air movement.
- Trees and dense vines can provide shade that is superior to artificially provided shade and are accepted as compliant sources of shade as long as branches, thorns and the plant itself does not pose added harm to the employee.
- The interior of a vehicle may only be used to provide shade when the vehicle is air conditioned and the air conditioner is operating.

INSERT FIGURE OF SITE MAP WITH LOCATIONS OF SHADED BREAK AREAS.

4. Work-Rest Cycles and Breaks

It is necessary to implement a work routine that incorporates adequate rest periods to allow employees to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest and recover.

The frequency and length of work breaks will be determined based on the following considerations:

- Employees are allowed and encouraged to take a preventative cool-down rest in the shade when they feel the need to do so to protect themselves from overheating. The breaks will last for a minimum of 5 minutes and as long as needed to resolve any signs/symptoms of heat illness that are observed.
- The SSO may determine the timing of work breaks based upon the ambient temperature, amount of sunshine, humidity, the amount of physical labor being performed, the physical condition of the employees, and protective clothing being used. The following guidelines shall be used to determine frequency and duration of rest breaks:

4.1 Adjusted Temperature Method

This method requires only that the ambient temperature (in °F [°C]) be known. Adjustment factors are applied to the ambient temperature to account for departures from ideal conditions (sunny conditions, light winds, moderate, humidity and a fully acclimated work force). The adjustments should be made by adding or subtracting the ambient temperature reading, or changes in table position, as indicated in Table 4-1. Adjustments are independent and cumulative; all applicable adjustments should be applied. The result is the *Adjusted Temperature*, which can be compared with the values in Table 4-2 for the applicable work rate (where light work corresponds to minimal physical activity besides standing/watching; very heavy work corresponds to significant, continuous physical labor) to determine the work-rest frequency.

Table 4-1 Temperature Adjustment Factors

Time of Day	
Before daily temperature peak[1]	+2°F (+1.11°C)
10 a.m. – 2 p.m. (peak sunshine)	+2°F (+1.11°C)
Sunshine	
No clouds	+1°F (+0.56°C)
Partly Cloudy (3/8 – 5/8 cloud cover)	-3°F (-1.67°C)
Mostly Cloudy (5/8 – 7/8 cloud cover)	-5°F (-2.78°C)
Cloudy (>7/8 cloud cover)	-7°F (-3.89°C)
Indoor or nighttime work	-7°F (-3.89°C)
Wind	
Gusts greater than 5 miles per hour at least once per minute	-1°F (-0.56°C)
Gusts greater than 10 miles per hour at least once per minute	+2°F (+1.11°C)
Sustained greater than 5 miles per hour	-3°F (-1.67°C)
Sustained greater than 10 miles per hour	-5°F (-2.78°C)
Humidity	
Relative Humidity greater than 90%	+5°F (+2.78°C)
Relative humidity greater than 80%	+2°F (+1.11°C)
Relative Humidity less than 50%	-4°F (-2.23°C)
Chemical Protective Clothing (CPC)	
Modified Level D (coveralls, no respirator) [2]	+5°F (+1.11°C)
Miscellaneous	
Unacclimated work force	+5°F (+2.78°C)
Partially acclimated work force	+2°F (+1.11°C)
Working in shade	-3°F (-1.67°C)
Breaks taken in air conditioned space	-3°F (-1.67°C)

°F = degrees Fahrenheit; °C = degrees Celsius

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

[2] Refer to S3AM-113-ATT1 for addition Chemical Protective Clothing (Type C – A)

Table 4-2 Work-Rest Schedule Based on Adjusted Temperature

Work-Rest Frequency	Adjusted Temperature – ºF (ºC)			
	Light Work	**Moderate Work**	**Heavy Work**	**Very Heavy Work**
No Specified requirements	< 80ºF (26.67ºC)	< 75ºF (23.88ºC)	< 70ºF (21.11ºC)	< 65ºF (18.33ºC)
15-minute break every 90 minutes of work	80–90ºF (26.67–32.2ºC)	75–85ºF (23.88–29.44ºC)	70–80ºF (21.11–26.67ºC)	65–75ºF (18.33–23.88ºC)
15-minute break every 60 minutes of work	> 90–100ºF (32.22–37.77ºC)	> 85–95ºF (29.44–35ºC)	> 80–85ºF (26.67–29.44ºC)	> 75–80ºF (23.88–26.67ºC)
15-minute break every 45 minutes of work	> 100–110ºF (37.77–43.33ºC)	> 95–100ºF (35–37.77ºC)	> 85–90ºF (29.44–32.22ºC)	> 80–85ºF (26.67–29.44ºC)
15-minute break every 30 minutes of work	> 110–115ºF (43.33–46.11ºC)	> 100–105ºF (37.77–40.55ºC)	> 90–95ºF (32.22–35ºC)	> 85–90ºF (29.44–32.22ºC)
15-minute break every 15 minutes of work	> 115–120ºF (46.11–48.88ºC)	> 105–110ºF (40.55–43.33ºC)	> 95–100ºF (35–37.77ºC)	> 90–95ºF (32.2–35ºC)
STOP WORK	**> 120ºF** (48.88ºC)	**> 110ºF** (43.33ºC)	**> 100ºF** (37.77ºC)	**> 95ºF** (35ºC)

ºF = degrees Fahrenheit; ºC = degrees Centigrade

4.2 Procedures for Taking Breaks

- Breaks will be taken in a cool and/or shaded location, in an air-conditioned environment when possible. A shaded break area is required when temperatures are above 80 ºF (26ºC).
- Employees will be monitored by the supervisor or SSO and asked if he or she is experiencing symptoms of heat illness.
- Each employee should self-assess and assess their co-workers for sign/symptoms of a heat-related illness.
- Employees will be encouraged to remain in the shade.
- All breaks will last a minimum of 5 minutes in addition to the time needed to access the shade.
- Employees will not be ordered back to work until any signs or symptoms of heat illness have abated.
- Pulse rate information should be collected to verify the effectiveness of the break and work-rest cycle.
- Water will be available, and consumption encouraged in the break area.
- Manual labor will not be performed during breaks, other than paperwork or similar light tasks.

4.3 Evaluating the Work-Rest Schedule's Effectiveness

Once a work-rest schedule is established, the SSO must continually evaluate its effectiveness through observation of employees for signs/symptoms of heat stress. Measurement of each employee's pulse can provide additional information in determining if the schedule is adequate and is accomplished as follows:
Within the first minute of each rest period, each employee's heart rate (pulse) can be measured and compared to the following:

- Initial heart rate: 110 beats per minute (bpm) (28 beats every 15 seconds).

Each employee's heart rate must be measured again 3 minutes later and compared to the following:

- Recovery heart rate: 80 bpm (20 beats every 15 seconds).
- If both heart rate criteria are met, the subsequent work period may be increased by one-third, provided the temperature remains constant.
- If the initial heart rate is greater than 110 bpm, or the recovery rate is not less than 80 bpm, the subsequent work shift is decreased by one-third.

If cooling devices (e.g., cooling vest) are worn, only physiological monitoring will be used to determine work activity. Measurements for each employee can be recorded and tracked throughout the workday using the Heat Stress Monitoring Log provided in S3AM-113_PR_Heat Stress.

5. Emergency Services

A minimum of two workers trained in cardio-pulmonary resuscitation (CPR) and First Aid will be present on site for all activities that expose employees to temperatures greater than 80ºF (27ºC). This is ideal, but may need to be adjusted for specific working conditions.
Means of contacting Emergency Services shall be validated in areas where cell phone reception is limited, and alternate reliable means will be selected.
Emergency Services will be activated if severe heat illness (such as, but not limited to, decreased level of consciousness, staggering, vomiting, disorientation, irrational behavior or convulsions) is observed or suspected.
An employee that exhibits signs or symptoms of illness shall not be left alone without first aid or medical treatment to resolve symptoms.
Refer the Site-Specific Emergency Action Plan for specific emergency instructions in the Task Hazard Analysis (THAs), Safe Work Plan or Health and Safety Plan.

5.1 Acclimatization

All employees shall be closely observed by a supervisor or designee during a heat wave. For purposes of this section only, "heat wave" means any day in which the predicted high temperature for the day will be at least 80ºF (27ºC) and at least 10 ºF (5 ºC) higher than the average high daily temperature in the preceding 5 days.
An employee who has been newly assigned to a high heat area shall be closely observed by a supervisor or designee for the first 14 days of the employee's employment.

5.2 Training of Employees and Supervisors

All AECOM employees and supervisors shall receive training in the prevention of heat-related illnesses prior to starting work. Training will include:

- Environmental risk factors for heat illness, including added burden of heat load on the body caused by exertion, clothing and PPE;
- Personal Risk Factors for heat illness such as an individual's age, degree of acclimatization, health, water consumption, alcohol consumption, caffeine consumption, and use of prescription medications that affect the body's water retention or other physiological responses to heat;
- AECOM's S3AM-113_PR_Heat Stress and a review of the site-specific procedure in this Safe Work Plan, and associated THAs;
- Signs, symptoms and response measures for different types of heat-related illnesses;
- Procedure for stopping work and reporting signs and symptoms of a heat-related illness in themselves or other people on site;
- First aid measure for managing a case of heat illness;
- AECOM's procedure for responding to heat-related illnesses, including use of AECOM's Corporate Medical Provider (Work Care), and seeking emergency medical services (see the site-specific Emergency Action Plan);

- Obtaining accurate weather forecast and ambient temperature data;
- Access to potable water, the minimum recommended consumption rate (1 quart per hour), procedure for drinking (small quantities regularly throughout the day, increase intake for higher heat, increased workload or increased sweating);
- Provision of shade required when temperatures are greater than 80ºF (27ºC);
- Acclimatization;
- How to establish a work-rest cycle per S3AM-113_PR_Heat Stress; and
- Specific high heat (95ºF [35ºC]) procedures.

6. High Heat Procedures (>95° F)

The following procedures shall be implemented when the temperature equals or exceeds 95ºF (35ºC). These procedures shall include the following to the extent practicable:

- Ensuring that effective communication by voice, observation, or electronic means is maintained so that employees at the work site can contact a supervisor when necessary. An electronic device, such as a cell phone or text messaging device, may be used for this purpose only if reception in the area is reliable.
- Conduct a pre-shift meeting to review high heat procedures, encourage water consumption, and review the work-rest cycle and supplemental breaks.
- Employees shall be monitored for signs and symptoms through an effective means of observation, which may include:
    - For teams less than 20, monitoring by a supervisor or supervisor designee (SSO).
    - For teams larger than 20, monitoring via the Buddy System.
    - Regular communication through cell phone or radio of a lone worker.

Note: for Lone Worker scenario an alternate means of monitoring the worker must be devised.

- Reminders to drink plenty of water throughout the work shift shall be provided by the SSO or Site Supervisor or from peer to peer.
- Designate an employee that is authorized to call Emergency Services in the event of an emergency

7. Identifying and Responding to Sign and Symptoms

Heat stress can be a significant field site hazard, particularly for non-acclimated personnel working in the desert. Site personnel must be instructed in the identification of heat-stress symptoms of heat-related illnesses. Employees are required to immediately report any signs of symptoms that they may experience or observe in fellow employees. The guidance below in Table 7-1 will be used in identifying and responding to heat-related illness. Any employee exhibiting a sign or symptom of a heat-related illness shall receive appropriate first aid or medical care through the AECOM supervisor, and AECOM's Incident Reporting process.

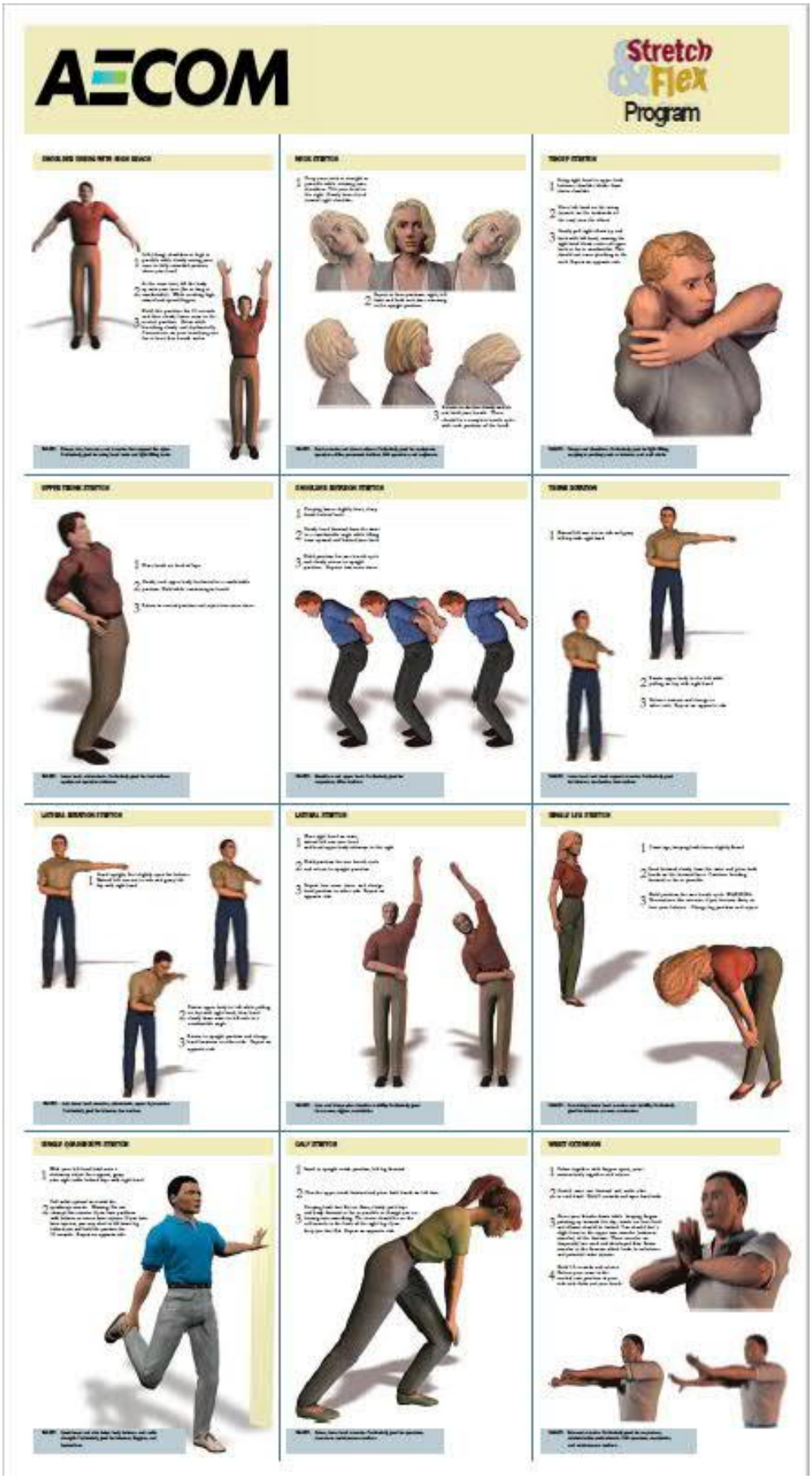
Table 7-1 Identification and Treatment of Heat-Related Illness

Type of Heat-Related Illness	Description	First Aid
Dehydration	*96% of the employees suffering from heat illnesses were dehydrated.* Dehydration results from in taking less water than your body is using (sweating). Dehydration results in reduced urine output, dark-colored urine, shriveled skin that doesn't "bounce back" when pinched, extreme thirst (not always), sleepiness, lack of sweat, dry skin, headache, constipation.	• Stop work and move employee to shaded rest/break area. • Drink water, slowly and steadily. • Report to SSO, contact Safety Professional/Work Care for guidance on fluid intake and returning to work.
Heat Rash	A heat rash occurs when sweat ducts become clogged and the sweat can't get to the surface of the skin. Instead, it becomes trapped beneath the skin's surface causing a mild inflammation or rash.	Avoid working in hot, humid weather, wear loose clothing made of breathable fabrics like cotton, use air conditioning, and keep the skin clean with frequent baths or showers to prevent sweat glands from becoming clogged. Change clothing that is wet or soiled. Heat rash can be treated by cleaning and cooling the area with cool water and applying an over-the-counter hydrocortisone cream. There is risk of infection from heat rash if sweat glands become infected. The signs of infection include pain, increased swelling, and redness that does not resolve. Pustules may form at the site of the rash. This infection occurs because bacteria have invaded the blocked sweat gland. Antibiotic treatment may be required. Chronic and recurrent heat rash may need to be treated by a health care practitioner or dermatologist (skin specialist).
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. • An air-conditioned spot 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 as soon as possible.

Type of Heat-Related Illness	Description	First Aid
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, and 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 with 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 on-site treatment of the victim and proper transport to a medical facility.

Attachment B

Stretch and Flex Poster



Attachment C

Task Hazard Assessments (THAs)

Task Hazard Assessment Instructions:

Each unique task or work group should have their own THAs. If workers have a THA for their task(s) in hand, they should simply review it and document the site-specific edits in red pen in the appropriate section. If workers do ***not*** have a THA for all tasks to be performed, a THA must be obtained or drafted *prior to starting work* on that task. Use additional pages as needed.

- Identify the basic steps of the task that must be performed in order and their associated hazards. Identify controls or barriers to mitigate each identified hazard.
- Clearly identify any **STOP WORK** triggers
- Document stop work and change management if conditions/ scope changes.
- Use 4-Sight to identify and mitigate site-specific hazards throughout the day. Modify the THA as needed. Contact site supervisors or the PM for any significant scope changes or changes of expected conditions.
- All THAs shall be 3 pages (maximum) or less (preferred). If they are longer, the task is too broad
- All hazards will use standardized nomenclature (Hazard Wheel), should be specific, detail how someone could be hurt and what the outcome could be
- All actions to mitigate hazards must be specific, clearly aligned with its respective hazard and not generic. Avoid words such as "*proper", "correct*", or "*appropriate*"). Use specifics and numerical values (i.e. wear disposable nitrile gloves, stand back 6 feet/1.8 meters, take a 10-minute break every hour)
- PPE cannot be the only line of defense - PPE is always the last line of defense, so think through what other controls (engineering, administrative, etc.) could mitigate hazards.

Discuss as Applicable and Modify THA as Needed

Check ☑ if reviewed or mark N/A

- ☐ *Biological/ Chemical/ Electrical Hazards*
- ☐ *Decontamination Procedures*
- ☐ *Ergonomics- Lifting, Body Position*
- ☐ *Lock Out/ Tag Out*
- ☐ *Short Service Employees- visual identifier and mentor/ oversight assignment*
- ☐ *Simultaneous/ Neighboring Operations*
- ☐ *Slip/ Trip/ Fall Hazards*
- ☐ *Specialized PPE Needs*
- ☐ *Traffic Control*
- ☐ *Waste Management/ Decontamination*
- ☐ *Weather Hazards/ Heat Stress/ Cold Stress*
- ☐ *Work Permit requirements (identify):*

- ☐ *Other (describe):*

Probability	Severity				
	5 - Catastrophic	4 – Critical	3 – Major	2 – Moderate	1 - Minor
5 – Frequent	25	20	15	10	5
4 – Probable	20	16	12	8	4
3 – Occasional	15	12	9	6	3
2 – Remote	10	8	6	4	2
1 - Improbable	5	4	3	2	1

Risk Rating (Probability x Severity)	Risk Acceptance Authority
1 to 4 (Low)	Risk is tolerable, manage at local level
5 to 9 (Medium)	Risk requires approval by Operations Lead/Supervisor & Safety Manager
10 to 25 (High)	Risk requires the approval of the Operations Manager & Safety Director

Severity – Potential Consequences				
	People	Property Damage	Environmental Impact	Public Image/Reputation
Catastrophic	Fatality, Multiple Major Incidents	>$1M USD, Structural collapse	Offsite impact requiring remediation	Government intervention
Critical	Permanent impairment, Long term injury/illness	>$250K to $1M USD	Onsite impact requiring remediation	Media intervention
Major	Lost/Restricted Work	> $10K to $250K USD	Release at/above reportable limit	Owner intervention
Moderate	Medical Treatment	> $1K to $10K USD	Release below reportable limit	Community or local attention
Minor	First Aid	</=$1K USD	Small chemical release contained onsite	Individual complaint

Probability		
Frequent	Expected to occur during task/activity	9/10
Probable	Likely to occur during task/activity	1/10
Occasional	May occur during the task/activity	1/100
Remote	Unlikely to occur during task/activity	1/1,000
Improbable	Highly unlikely to occur, but possible during task/activity	1/10,000

Using the Matrix:

1. Identify basic steps of the task and associated hazards.
2. Calculate the initial risk rating.
3. Identify control measure to eliminate or reduce the hazard's risk and calculate the residual risk rating.
4. If the risk rating (after controls are implemented) cannot be reduced to 4 or lower, additional approvals are needed before the activity can begin.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Aerial Lift Operations**	**Control #:**	**01-01-08-02**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	1/15/20
Permits Required? (list):	No	**Work Location:**	Columbia Cement building		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat	☒ Safety Glasses	☒ HiVis Vest	☒ Safety Toe Boots n	☒ Gloves: Cut/impact resistant ANSI 2	☐ Hearing Protection	☒ Other: Fall Protection
Tools & Equipment:	Scissor lift, Bucket lift						

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Inspect manlift and designate roles for personnel **Operator** – ***Responsible*** for the safe operation of the manlift and integrity of the personnel on the manlift. **Spotter(s)** – ***Responsible*** for maintaining the integrity of the area surrounding the lift, monitoring the load stability and clearance around obstacles, monitoring the operator's blind spots, and communicating observations to the operator.	1a. Exposure to falls due to damaged equipment. 1b. Pinch / Amputation points	**10** **10**	1a. Review and complete the following: • Inspect manlift for leaks, damaged components, and integrity of tracks/tires. • Test the operation of all safety devices, controls, and brakes. • Keep hands away from lifting mechanism at all times. • Turn off machine during maintenance/fueling operations. • Follow the manufacturer's guidelines for maintenance. • Operator must have appropriate local training to operate a manlift, • Don appropriate PPE (listed above), especially fall protection (safety harness) before entering manlift to conduct initial inspection. Ensure that all PPE is in good condition and has no defects. (i.e. tears, rust, frays in the lanyards, etc.) ***Note:*** *The operator should stop the machine, apply the parking brake, and personally check any questionable items or conditions before proceeding.* 1b. Do not place any body part in a pinch point between a moving load and any inanimate objects. Keep hands clear of wire rope and rigging.	2 2
On-Site Edits:				
2. Inspect areas of operation / set-up work zone	2a. Contact with overhead obstructions (power lines, building roof), site personnel	**10**	2a. Delineate a zone around the designated work areas to keep bystanders away from manlift operations. • Manlift will remain stationary and should not be moved with bucket/platform raised in the air.	2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Aerial Lift Operations**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
			• Review access to buildings/objects for mast/load clearance, obtain safe clearance distances from electrical utility providers. • Minimize situations where backing-up will be necessary. • Instruct bystanders on work zone requirements, erect barricades and post necessary signage around work zone. • A secondary person must be on the ground at all times, to act as a spotter for the personnel in the basket.	
	2b. Exposure to adverse weather conditions (i.e. rain, wind gusts, etc.) causing lift to tip.	8	2b. Check the current and future weather conditions, prior to starting any work. If adverse weather conditions are observed, STOP WORK and contact the Site Supervisor / Project Manager. Once the basket is raised, the weather conditions may change (i.e. winds may increase), making it dangerous to operate the manlift.	2
	2c. Crushed by unstable equipment (tip over)	8	2c. Set the equipment's outriggers, prior to engaging the lift to perform an inspection or operate (if available). Do not position the manlift on uneven or soft ground surfaces.	2
On-Site Edits:				
3. Raising/lowering the manlift basket	3a. Contact with overhead obstructions (power lines, building roof), site personnel	**10**	3a. When raising the basket, review the path of the basket and check for and maintain required distance to overhead power lines, obstructions, etc. When lowering the basket, review the path of the basket and check for personnel or other obstructions.	2
	3b. Falling out of bucket	8	3b. All personnel inside the basket are required to have received Fall Protection Training and wear the appropriate fall protection (i.e. Full body safety harness with self-retracting lanyard). A Competent Person must inspect and approve of the anchorage point for the safety harnesses, before the basket is raised in the air.	2
	3c. Slip/Trip/Fall due to loose tools on the work platform	4	3c. There should be no debris or tools on the platform (secure all tools/equipment needed for sampling before raising lift)	2
	3d. Contact/rotating machinery/pinch points	8	3d. Spotter will confirm path of basket is clear and all proper distance is maintained by all personnel (min 1.5 meters, or 15 feet).	4
	3e. Wind/foul weather hazards	6	3e. Review the weather forecast for potentially gusty wind conditions or heavy precipitation. • Gusts of wind can cause unexpected shift in the basket and contact with overhead objects. • Heavy rain and snow can cause slippery conditions in the basket and affect line of site and distance judgment. • Do not operate the manlift in adverse weather conditions and discontinue operation of the manlift if weather conditions change during the task.	3

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Aerial Lift Operations	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
On-Site Edits:				
4. Traversing while the basket is raised	4a. Contact with obstructions, site personnel 4b. Falling out of bucket	8 **10**	4a. Follow the designated pathway at a speed appropriate for the terrain and equipment. • Maintain the basket in a position that does not interfere with lines of sight. • Use a spotter while traversing 4b. Do not drive the lift in an extended position unless it is specially designed to do so. • Maintain basket in a position as low to the ground surface as possible to keep the center of gravity as low as possible. • Fall protection PPE (i.e. Full body harness and self-retractable lanyards) must be worn at all times. • Plan the path of travel prior to mobilizing the man lift. Ensure that the ground surface is stable and not uneven or soft.	4 3
On-Site Edits:				
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Aerial Lift Operations	Error! Reference source not found.

All Employees:

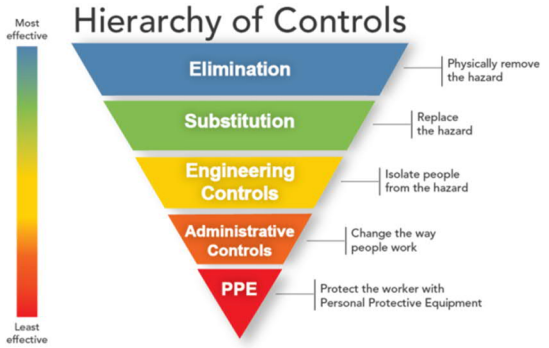
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
1. Supervisor:	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Submit a new THA for addition to the DCSA THA Library or send THA improvement suggestions to DCSA.THA.Library@AECOM.com

Task Hazard Analysis

Task Name:	Aerial Lift Operations	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

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Task Name:	**DRILLING, GROUTING, MONITORING WELLS**	**Control #:**	**01-01-03-07**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/27/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site and surrounding areas		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, nitrile ☒ Hearing Protection ☐ Other:
Tools & Equipment:	Cutting tools

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Pre-mobilization, Equipment Inspection. Contact One-Call, private utility contractor, and/or site personnel to locate and mark underground utilities.	1a. Injury from equipment malfunction 1b. Failure to have underground utilities identified could result in explosion, electrocution, injury, death, property damage.	5 **10**	1a. Ensure that PM or person responsible for scheduling rental equipment requests that the vendor inspects the equipment prior to site delivery to ensure all appliances are in working order and fit for use. 1b. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location. Complete utility checklist form.	4 4
On-Site Edits:				
2. Setup Drill Rig and work zone	**2a**. Struck by vehicle or equipment traffic **2b**. Sprain or broken bones due to slip, trip or fall **2c**. Struck-by, crushed-by, caught-by drill rig.	8 6 **10**	**2a**. Verify that drilling contractor inspects equipment daily using S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection or equivalent. Verify that kill switch on rig is tested and operational. Establish work zone using traffic control devices, signs, cones, etc. in advance of initiating monitoring well abandonment activities. Restrict access to observers and passersby. **2b**. Maintain required housekeeping in work area, do not carry equipment where visibility of ground is impaired, remove or mark all trip hazards in work area. **2c**. Communicate path of movement to all project personnel. Establish and use agreed upon hand signals during spotting activities. Always use a spotter(s) to direct movement of drill rig and watch for vehicle and pedestrian traffic. Additional spotter(s) will be used in	4 2 4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.**01-01-03-07**

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
			high traffic areas and in areas with blind spots where traffic is difficult to observe. Chock wheels ensure outriggers/jacks are used.	
	2d. Contact with overhead utilities.	**10**	**2d**. Keep a minimum of 15 feet from overhead power lines (20 ft. if 230-285 KV, 25 ft. if 285-345 KV, 35 ft. if 345-500 KV) Check HASP to ensure client/site does not have stricter requirements. Mast shall be down when rig is in motion.	4
	2f. Hydraulic failure causing release to the environment.	**10**	**2f**. Place secondary containment on ground under rig. Ensure that secondary containment is setup with 'berms/barriers' or containment is securely clipped onto the rig tracks/wheels to protect from any fluid leaking off the plastic.	3
On-Site Edits:				
3. Commence drilling	**3a.** Cuts, contusions or broken fingers due to contact with moving parts	6	**3a**. Never place hands, fingers, feet under the bottom of an auger flight, or other location where these heavy items could be set down or could fall suddenly.	2
	3b. Entanglement	**10**	**3b**. Ensure rotating parts are properly guarded. Remove loose clothing and jewelry that could become entangled in moving parts. Use a long handled shovel to remove cuttings from the auger/rods.	4
	3c. Noise	6	**3c.** Wear hearing protection while equipment is in use.	2
	3d. Back strain/ overexertion when unloading equipment	8	**3d.** Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds.	4
	3e. Contusions to face or eyes due to flying/shattering objects	8	**3e.** Have bystanders maintain a 5 foot distance from the operation at all times. Set up work area the mast plus 5 feet and no less than 30 feet. Wear all required PPE.	4
	3f. Hand positioning/pinch points	8	**3f.** Wear leather or thick puncture-resistant gloves, communication between driller, helpers, and logger. All pinch point hazards should be labeled on rig with warnings.	4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.**01-01-03-07**

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
On-Site Edits:				
4. Inspect grout mixer/pump	**4a.** Personnel, property, and/or equipment damage due to failure to inspect mixer/pump properly	6	**4a.** Read start-up and shutdown procedures shown on grout mixer/pump or read operating manual that accompanies unit. Check all fluid levels if equipped with gas engine. Be familiar with how to shut off mixer/pump in case of an emergency. Check that unit has adequate amount of fuel in the tank. Check all hydraulic hoses and fittings for leaks, wear, and proper connection. Ensure all guards are in place.	2
	4b. Skin irritations or labored breathing due to contact with fuel	3	**4b.** Never overfill tank due to fuels expanding when heated. Make certain that fuel cap is fastened tight. Wear nitrile gloves underneath leather gloves during inspection	1
On-Site Edits:				
5. Grouting, Installing Well Pad	5a. Exposure to cement dust and mixed cement, skin, eye, and inhalation	6	5a. Wear a dust mask to protect against airborne particles. Wear leather gloves when adding materials to mixing tank. Open bags of dry materials in a controlled manner to minimize dust. Try to stay upwind from grout mixing.	2
	5b. Injury from entanglement in drive shaft or mixing paddles	6	5b. Do not reach into the mixing tank during operation. Do not wear loose clothing or use tools that could become entangled in drive shaft or mixing paddles. Turn the unit off before attempting to service the mixer or clear debris.	2
	5c. Splashes and spills	4	5c. Wear face shield to guard against splashes. Add water or other liquid additives in a controlled manner to avoid splashes. Do not exceed the capacity of the mixing tank	1
	5d. Muscle strain	9	5d. Stage bags of dry materials as close to mixer as possible. Use a buddy to help move heavy bags. If possible, lower the height of mixer to minimize lifting.	3
				2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.**01-01-03-07**

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	5e. Hand injury from opening bags on breakers. Pinch points. 5f. Cuts or contusions to hands, fingers from assembling well frame	6 8	5e. Wear leather gloves when placing bags of dry materials onto bag breakers. Do not place hands between heavy bags and the bag breakers. 5f. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools	4
On-Site Edits:				
6. Debris handling and disposal	6a. Cuts and abrasions and pinch points during debris handling	6	6a. Note pinch points and sharp edges on concrete, well vaults, protective casings, metal skirts, and bollard debris and avoid. Don leather gloves	4
On-Site Edits:				
7. Environmental Concerns while on site	7a. Inclement weather	**10**	7a. Check weather forecast daily, have appropriate clothing and gear for weather conditions	6
	7b. Hypothermia	**10**	7b. Discuss symptoms of hypothermia before deployment. Have a means of warming (hot liquids, hand warmers, etc., and a set of dry clothing, etc. available on the vessel. Change into dry clothing if you become wet at cold temperatures.	5
	7c. Heat stress/heat illness	6	7c. Provide drinking water and electrolytes. Have a heat stress control plan (including shelters, work rotation, methods of cooling). Review prevention, symptoms and treatment guidance before deployment.	4
	7d. Sunburn	8	7d. Wear sunscreen and hat, prevent as much solar exposure as possible	5
	7e. Biological Hazards	6	7e. Assess work area for poisonous plants and communicate observations to avoid them. All field clothing and equipment should be thoroughly cleaned, removed and/or segregated from clean clothing, equipment and supplies to avoid transfer of hazardous plants oils and inspects. If contact with poisonous plants or ticks are unavoidable, use controls including the use of disposable (Tyvek) coveralls, insect	4

Task Hazard Analysis

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Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.**01-01-03-07**

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Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
			repellent (23.8% DEET or similar), light colored clothing, barrier creams, and frequent tick checks. All employees should bath immediately following fieldwork and use soaps/ cleansers designed to remove oils associated with poison oak, and conduct a full body tick check using a mirror. If any crew member has a bee allergy, they must have at least one EpiPen properly stored on site.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.**01-01-03-07**

All Employees:

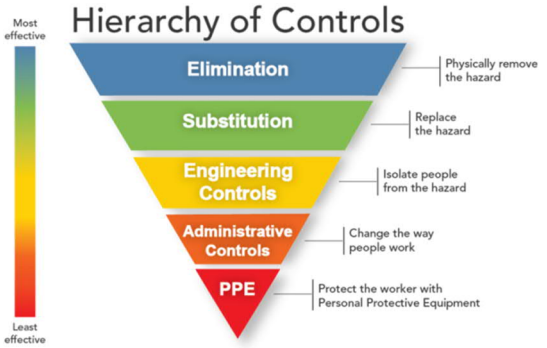
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
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Visitors review task hazards and acknowledge understanding
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Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.**01-01-03-07**

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Driving to and From Site**	**Control #:**	**01-01-12-02**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/27/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☐ Hard Hat ☐ Safety Glasses ☐ HiVis Vest ☐ Safety Toe Boots ☐ Gloves: Leather / Nitrile ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Emergency kit Communication device (cell phone) Navigation system

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Trip Planning	1a. Unauthorized driving	9	1a. You must be an AECOM authorized driver to drive for AECOM business purposes. Consult the requirements of S3AM-005-PR1. Authorized Drivers shall maintain a current driver's license with full privileges applicable to the vehicle to be operated. Develop a Journey Management Plan if applicable.	4
	1b. Inclement weather	6	1b. Evaluate weather conditions prior to beginning the travel to determine if travel should proceed. Verify your vehicle is equipped to travel in poor weather. Have supplies on hand in the event that you become stranded, including a communication device to call for help.	4
	1c. Getting Lost	6	1c. Review route in advance and program GPS prior to leaving	3
	1d. Inadequate vehicle for the site/trip	7	1d. Understand what type of vehicle is necessary to transport tools & equipment to the site. Know site conditions before departure and obtain proper vehicle, 4-Wheel drive if necessary	4
	1e. Vehicle malfunction	8	1e. Inspect vehicle prior to leaving. Verify that maintenance records are current.	4
On-Site Edits:				
2. Driving	2a. Fatigue	**15**	2a. Start trip well rested & take breaks when needed. Share driving responsibilities where possible. **STOP DRIVING AND PULL OVER** in a safe place if you begin nodding off or showing other signs of fatigue.	4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Driving to and From Site	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
	2b. Risky driving practices	**15**	2b. Practice defensive driving techniques and avoid bad driving habits • Allow for adequate time to make the trip • Do not speed or attempt to multi-task • Do not use cell phone or text or attempt to program GPS while driving	4
On-Site Edits:				
3. Stops/breaks during transit	3a. Theft of equipment/materials	6	3a. Place any likely theft items out of sight and lock vehicle when leaving it. Do not leave vehicle unattended for longer than necessary. If at all possible, avoid leaving packed vehicles in public parking areas overnight, unload if possible. Park in well lighted areas.	4
	3b. Personal security risk	**10**	3b. Be alert and aware of surroundings when making stops. Stop at areas which are well lit and have security if possible.	3
On-Site Edits:				
4. Starting a trip	4a. Striking unseen object	**6**	4a. Perform walk-around survey of car before starting. Remove any objects or debris around car that could puncture tires. Check for leaking car fluids.	**2**
On-Site Edits:				

Additional Notes:

Task Hazard Assessment

AECOM Imagine it. Delivered.

All Employees:

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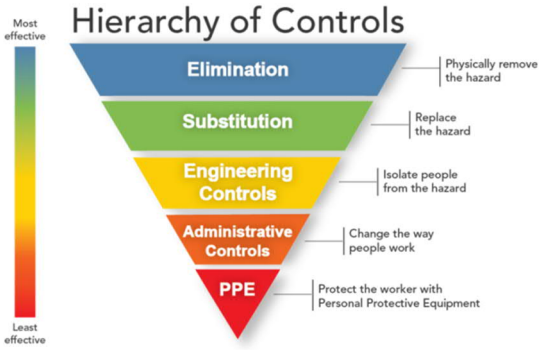

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Gauging Liquid Levels in Groundwater Monitoring Wells	**Control #:**	01-01-05-07

Project Name:	**P-IPO**	**Client:**	BP	**Date:**	7/27/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, nitrile ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Hand Tools Liquid level/Interface probe Decon materials

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Visually clear proposed gauging locations	1a. Exposure to biologic hazards: insects, poisonous plants and animals. Injuries could include anaphylactic shock, allergic reaction, rabies	6	1a. Identify and avoid hazardous plants and animals on site. Look for signs (spider webs, droppings, etc.). Wear cut resistant gloves, insect repellant; use a broom or a rake to move vegetation, not your hand or foot; move slowly	4
	1b. Damage to equipment or vehicles due to surface / subsurface obstructions	6	1b. Investigate travel path. Look for surface obstructions such as rubble, debris, old foundations or rebar. Use spotter is available or park in such a manner as to not have to back-up.	4
	1c. Slips / trips / falls due to uneven terrain resulting in broken bones or torn ligaments.	6	1c. Identify, mark and avoid slip, trip and fall hazards (holes, obstructions protruding from the ground, or debris). Contact PM immediately and do not proceed if any conditions are observed that cannot be controlled to make well gauging in the area safe.	4
	1d. Struck by vehicle resulting in severe trauma or death	**10**	1d. Visually inspect roadway for moving equipment if walking and set up vehicle as a barrier if driving. Set up exclusion zone around each well. Don reflective vest	4
On-Site Edits:				
2. Opening well casings / flush-mount covers and well plug lock	2a. Cuts / lacerations / crushing, bruises	6	2a. Avoid touching sharp materials/ edges. Wear cut resistant ANSI 2 gloves. Keep face, hands, fingers, and feet clear when opening and closing well cover. Inspect ground before kneeling, don knee pads.	2
	2b. Back strain	4	2b. Stretch before working. DO NOT use awkward positioning. Keep back straight. Take regular rest/stretch breaks. Change position regularly.	2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Gauging Liquid Levels in Groundwater Monitoring Wells**	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	2c. Vapor exposure resulting in inhalation hazards or illness	4	2c. Stand upwind from the well opening to avoid vapor exposure. Loosen well cap slowly, keeping control if pressure is released due to vapors. Keep face out of line-of-fire.	2
	2d. Biologic hazards: insects, poisonous plants, and animals	6	2d. Slowly lift the well cover away from person and look for insects underneath the well. Use long handle tool to remove or kill any insects (i.e. screwdriver).	4
On-Site Edits:				
3. Lowering fluid meter probe and measuring tape to detect fluid level and total depth	3a. Cuts / lacerations / bruises to knees (flush mount)	4	3a. Inspect ground before kneeling. Remove any objects. Don knee pads	2
	3b. Aches and strains from repetitive motion	4	3b. Do not use awkward positioning. Keep back straight, take regular rest/stretch breaks. Change position regularly.	2
	3c. Exposure to chemical hazards in groundwater resulting in skin irritation or illness	3	3c. Use smooth movements to avoid splashes. Don nitrile gloves over cut resistant gloves and safety glasses with side shields. Check gloves for damages/ rips.	2
On-Site Edits:				
4. Removing fluid meter measuring tape and probe from well	4a. Exposure to chemical hazards in groundwater resulting in inhalation hazard or illness	4	4a. Stay upwind to avoid vapor exposure.	2
	4b. Cross contamination of equipment	4	4b. Clean the tape and probe using non-phosphate soap and distilled water. Wipe with clean paper towel. Collect decontamination materials for waste disposal. Wear disposable nitrile gloves.	2
	4c. Cuts / lacerations / bruises to knees (flush mount)	4	4c. Don knee pads and inspect ground before kneeling down and take frequent breaks to stand and stretch.	2
	4d. Aches and strains from repetitive motion	4	4d. See Step 3b.	2
	4e. Trips / falls from entanglement in measuring tape	3	4e. Check for location of measuring tape before walking or moving around.	2

Task Hazard Analysis

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On-Site Edits:				
5. Closing well casings / flush-mount covers	5a. Cuts / lacerations / crushing / bruises	4	5a. Avoid touching sharp materials/ edges. Keep face, hands, fingers, and feet clear when opening and closing well cover. Don knee pads and inspect ground before kneeling down.	2
	5b. Back strain from heavy / awkward materials handling	4	5b. Keep back straight. Take regular rest/stretch breaks. Change position regularly. * Verify that well covers are secure upon departure.	2
On-Site Edits:				
6. Gather gauging equipment and tools, place in work vehicle	6a. Cuts / lacerations / crushing / bruises from gathering or dropping equipment	3	6a. Maintain a secure grip on equipment and only carry manageable amount of equipment when demobilizing.	2
	6b. Aches and strains from improper lifting	4	6b. Bend and lift with legs. Keep back straight. Take regular rest/ stretch breaks. Change position regularly. Team lift is required for items over 50 lbs. (or awkward items). * Verify all tools and equipment are removed from the site.	2
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

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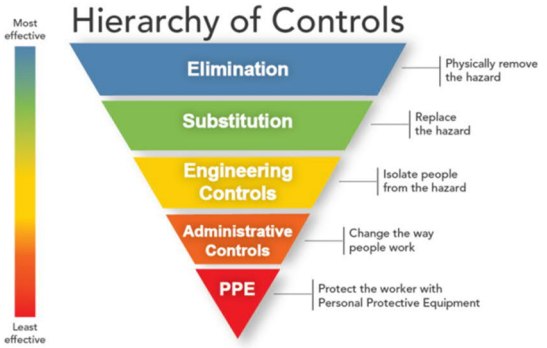

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Task Hazard Analysis

Task Name:	Gauging Liquid Levels in Groundwater Monitoring Wells	Control #:	Error! Reference source not found.

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Geoprobe Drilling Oversight	Control #:	01-01-03-01

Project Name:	BP-IPO Columbia Cement	Client:	BP	Date:	7/27/21
Permits Required? (list):	Nop	Work Location:	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, nitrile ☒ Hearing Protection ☐ Other:
Tools & Equipment:	

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
1. Mobilization	1a. Striking unidentified underground utilities	15	1a. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location.	4
	1b. Striking overhead utilities	15	1b. Follow the requirements of S3AM-322-PR1 Overhead Lines. Verify adequate clearance of all drilling locations prior to setting up at drilling location.	4
On-Site Edits:				
2. Setting up at drilling location	2a. Biological hazards causing bites, stings or other injury	8	2a. Examine ground surface for biological hazards prior to setting up equipment. If biological hazards exist, move equipment to a different area for set up if possible. Machetes, or other fixed open blade tools, are not permitted for clearing vegetation. Use insect repellent and check clothing for ticks periodically when applicable.	4
	2b. Struck by traffic	10	2b. Be alert to other vehicles or pedestrians if work area is in an area with public access. Communicate with any heavy equipment operators in the area to ensure they know where you and the equipment are located. Don high visibility vest.	4
	2c. Unstable Rig platform	10	2c. Verify with contractor that rig is set up level and properly chocked and blocked.	2
On-Site Edits:				

Task Hazard Analysis

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Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

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Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
3. Oversight of rig inspection	3a. Mechanical failure of equipment	**10**	3a. Verify that drilling contractor inspects equipment daily using S3AM-321-FM1 Daily Drilling, Boring & Direct-Push Equipment Inspection or equivalent.	4
	3b. Emergency shut off disabled	6	3b. Verify that kill switch on rig is tested and operational	3
On-Site Edits:				
4. Drilling Oversight	4a. Flying debris, caught by/ struck by injuries	8	4a. Keep a safe distance away during rig operation. Do not talk on cell phone or be distracted by paperwork when in immediate proximity to rig. Wear PPE including hard hats, steel-toe safety boots, safety glasses, and hearing protection.	4
	4b. Caught in/by equipment	**10**	4b. Keep hands, feet and other body parts shall be kept away from moving parts. Do not approach operator without making eye contact and getting approval.	4
	4c. Exposure to contaminants	8	4c. Position yourself upwind of the borehole whenever possible. Perform air monitoring using a PID as described in the HASP. **STOP WORK** if the action level is exceeded.	4
	4d. Noise-induced hearing loss	5	4d. Setup away from noisy operations. Don't be near the rig when hammering. Wear hearing protection.	3
On-Site Edits:				
5.	5a.		5a.	
On-Site Edits:				
6.	6a.		6a.	
On-Site Edits:				

Task Hazard Analysis

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Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
7.	7a.		7a.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

All Employees:

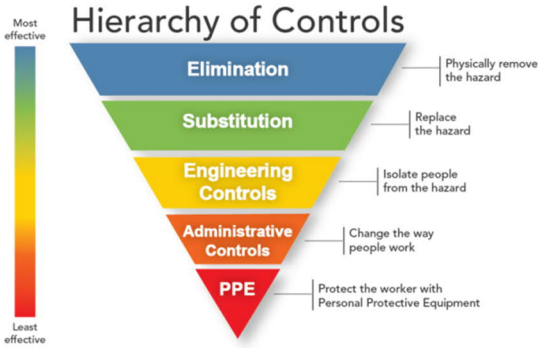
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
1. Supervisor:	
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Visitor Acknowledgement
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Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Groundwater Sampling – Low Flow**	**Control #:**	**01-01-05-12**

Project Name:	**BP-IPO**	**Client:**	BP	**Date:**	7/28/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, nitrile, cut resistant ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Hand tools YSI Pump

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Visually clear proposed sampling locations	1a. Exposure to biological hazards: insects, poisonous plants and animals. Injuries could include anaphylactic shock, allergic reactions, rabies.	6	1a. Identify and avoid hazardous plants and animals on site. Look for signs (spider webs, droppings, etc.). Wear cut resistant gloves, insect repellant, use a broom or a rake to move vegetation, not your hand or foot, move slowly	4
	1b. Slip/trips, falls due to uneven terrain resulting in broken bones or torn ligaments.	6	1b. Identify, mark and avoid slip, trip and fall hazards (holes, obstructions protruding from ground, or debris). Contact PM immediately and do not proceed if any conditions are observed that cannot be controlled to make well sampling in the area safe.	4
	1c. Struck by vehicle resulting in severe trauma or death	**10**	1c. Visually inspect roadway for moving equipment if walking and set up vehicle as a barrier if driving. Set up exclusion zone around each well. Don reflective vest.	4
On-Site Edits:				
2. Open well casing/flush-mount covers and well plug lock.	2a. Cuts/lacerations/crushing, bruises	6	2a. Avoid touching sharp material/edges. Wear cut resistant ANSI 2 gloves. Keep face, hands, fingers, and feet clear when opening and closing well cover. Inspect ground before kneeling. Don knee pads.	2
	2b. Back strain from improper lifting	4	2b. Stretch before working. DO NOT use awkward positioning. Keep back straight. Take regular rest/stretch breaks. Change position regularly.	2
		4	2c. Stand upwind from the well opening to avoid vapor exposure. Loosen well cap slowly, keeping control if pressure is released due to vapors. Keep face out of line-of-fire.	2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	2c. Vapor exposure resulting in inhalation hazards or illness 2d. Biologic hazards; insects, poisonous plants, and animals	6	2d. Slowly lift the well cover away from person and look for insects underneath the well. Use long handle tool to remove or kill any insects (i.e. screwdriver).	4
On-Site Edits:				
3. Installing tubing in well and setting up equipment.	3a. Cuts/lacerations/crushing, bruises	6	3a. Avoid touching sharp material/edges. Keep face, hands, fingers feet clear when cutting tubing and setting up equipment. Wear cut resistant ANSI 2 gloves with disposable nitrile over gloves	2
On-Site Edits:				
4. Removing tubing from well	4a. Exposure to chemical hazards in groundwater resulting in inhalation hazard or illness 4b. Cuts/lacerations/bruises to knee (flush mount)	4 4	4a. Stay upwind to avoid vapor exposure 4b. Don knee pads and inspect ground before kneeling down and take frequent breaks to stand and stretch	2 2
On-Site Edits:				
5. Closing well casings/flush mount covers	5a. Cuts/ lacerations/crushing, bruises 5b. Back strain from heavy/awkward material handling	4 4	5a. Avoid touching sharp material/edges. Wear cut resistant ANSI 2 gloves. Keep face, hands, fingers feet clear when closing well cover. Don knee pads and inspect ground before kneeling down. 5b. Keep back straight. Take regular rest/stretch breaks. Change position regularly.	2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
On-Site Edits:				
6. Gather sampling equipment and tools, place in work vehicle	6a. Cuts/lacerations/crushing/bruises from gathering or dropping equipment 6b. Aches and strains from improper lifting	3 4	6a. Maintain a secure grip on equipment and only carry manageable amount of equipment when demobilizing. 6b. Bend and lift with legs. Keep back straight. Take regular rest/stretch breaks. Change position regularly. Team lift is required for items over 50 lbs (or awkward items)	2 2
On-Site Edits:				
7.	7a.		7a.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

All Employees:

STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

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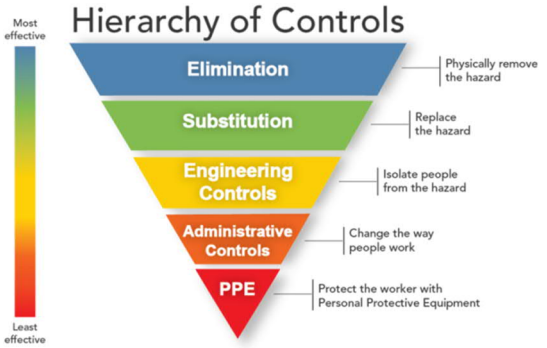

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Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Hand and Power Tools**	**Control #:**	**01-01-08-01**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/27/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☐ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Boots ☒ Gloves: cut/impact resistant based on Glove Needs Assessment ☐ Hearing Protection : based on hearing protection ☐ Other: needs assessment
Tools & Equipment:	Hand and Powered Tools, e.g., drills, sledgehammers, shovels, digging bars, sanders, hammers

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Using Hand or Power Tools	1a. Broken bones or cuts due to improper tools for task	8	1a. Inspect tools prior to use. Broken or worn tools should be repaired or replaced. Use tools for their intended purpose to avoid unexpected failure. Don leather gloves and safety glasses when inspecting tools.	3
	1b. Cuts, contusions or sprains to various body parts due to tool use	8	1b. Look around and behind you before starting. • Inspect tools prior to use. Broken or worn tools should be repaired or replaced. Use tools for their intended purpose to avoid unexpected failure. • Ensure work area is free of clutter or other workers which may interfere with ability to handle tools safely. • Do not swing or apply tool (sledge hammer, shovel, digging bar) until area is free of bystanders. • Do not use extreme force. Use controlled motions and avoid having prying tool "break free". • Ensure limbs such as hands, and digits such as fingers and toes, are out of the "line of fire" prior to undertaking the task. • Review and understand manufacturer's instructions and ensure they are followed. • Use tools only for tasks they were designed/intended, not as stand-in for tools unavailable.	8

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Hand and Power Tools**	**Control #:**	Error! Reference source not found.**01-01-08-01**

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
			• Don safety glasses, leather gloves.	
	1c. Slips, trips, and fall injuries	8	1c. Practice required housekeeping and frequently clear debris if created by the use of the hand or power tools. Keep unused tools off the ground. Do not carry debris long distances for disposal; if possible, park support vehicles in close proximity to well.	3
	1d. Eye or body injury from flying debris	8	1d. Observers should maintain a 2' distance from the area of work, have donned protective PPE, and are outside of the "line of fire". Remain vigilant as a support to the worker handling the tools, and do not distract or interfere abruptly with that worker.	3
On-Site Edits:				
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On-Site Edits				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Hand and Power Tools	Control #:	Error! Reference source not found.**01-01-08-01**

All Employees:

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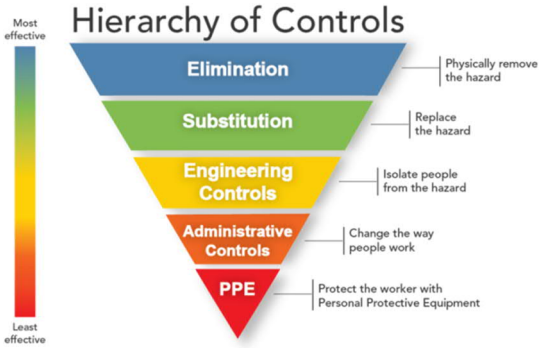

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Task Hazard Analysis

Task Name:	Hand and Power Tools	Control #:	Error! Reference source not found.**01-01-08-01**

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Investigation Derived Waste Management**	**Control #:**	**01-01-14-02**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/28/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☐ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather or work gloves with Nitrile undergloves	☐ Hearing Protection	☒ Other: Tyvek as needed to protect skin and clothing	
Tools & Equipment:	Socket set	55-gallon open top drum	Emergency eyewash and rinse water	Spill kit Photoionization detector with 11.7 eV lamp

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Secure work area from traffic	1a. Struck by traffic	10	1a. Establish work area so that each site vehicle used for activity are in close proximity of each other; this would prevent unnecessary trips outside of work zone and into potential traffic area. Establish barricaded area using cones and barricade tape. Wear required highly visible clothing.	4
On-Site Edits:				
2. Prepare work area	2a. Trips & falls 2b. Tools and emergency equipment not present	6 8	2a. Clear any trip/fall hazards from work area. Scan ground prior to moving or walking 2b. Obtain tools and emergency equipment and stage adjacent to work area	4 4
On-Site Edits:				
3. Remove drum lid	3a. Pinch points at drum ring 3b. Sharp edges on drum ring or rim	6 7	3a. Use socket set to loosen drum ring, avoid placing fingers in to pinch points. Make sure cut-resistant gloves fit properly (not too big so fingertips get caught) 3b. Evaluate rim and ring for sharp edges, avoid handling as much as possible. Wear cut resistant gloves	4 4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found. **Investigation Derived Waste Management**	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
On-Site Edits:				
4. Load soil into drums	4a. Exertion/sprains/strains	8	4a. Exertion/sprains/strains • Use proper lifting techniques; this consists of bending your knees and lifting with your back straight. • Shovel loads heavier than 50 lbs or awkward to handle use a mechanical loading device or ask for help. • Grasp shovel handle properly: Position one hand at base of shovel handle and your other hand near the top of the handle. • Rotate task with others if needed and take breaks.	7
	4b. Exposure to contaminants	6	4b. Exposure • Set up upwind of drum. • Wear PPE (e.g., eye protection-goggles, long pants, Nitrile exam gloves, Nitrile over-gloves (11-mil), long wrist) Tyvek coveralls, shirt with sleeves, steel-toed shoes with boot covers, half-face air purifying respirator fitted with an organic vapor, acid, HEPA filter combination cartridge). • Perform air monitoring as per HASP. **STOP WORK** if action level is exceeded.	4
	4c. Slips/trips/falls	6	4c. Be alert for uneven and slippery terrain. Keep tools and equipment away from walking paths.	4
	4d. Sharp edges on drum rim	6	4d. Inspect rim for sharp and rough edges, avoid leaning into drum or placing hands onto rim edge Wear cut-resistant gloves	2
On-Site Edits:				
5. Replacing drum ring	5a. Pinch points	7	5a. Use socket set to tighten drum ring, avoid placing fingers in to pinch points. Make sure gloves fit properly (not too big so fingertips get caught)	5

Task Hazard Analysis

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Task Name:	Error! Reference source not found. **Investigation Derived Waste Management**	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
On-Site Edits:				
6. Moving/relocating drums	6a. Exertion 6b. Trips and Falls	**15** **6**	6a. Exertion • If drums must be moved utilize a drum dolly. • DO NOT ATTEMPT TO "WALK" or "ROCK" DRUMS TO MOVE THEM. • Drums can become unstable and easily tip-over causing possible damage and personal injury as well as releasing the material contained. 6b. See 2a above	4 5
On-Site Edits:				
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On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found. **Investigation Derived Waste Management**	Control #:	Error! Reference source not found.

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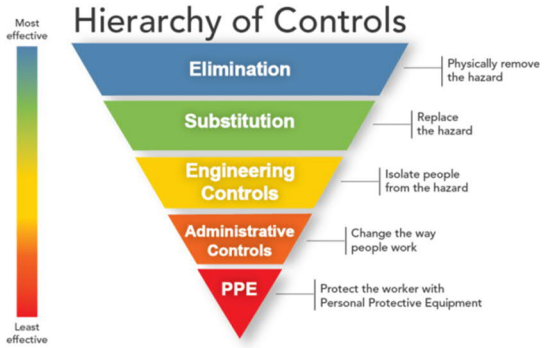

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Task Hazard Analysis

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Inspection of Sub-Slab Depressurization System / Vapor Intrusion Mitigation System	Control #:	01-01-07-08

Project Name:	BP-IPO Columbia Cement	Client:	BP	Date:	7/29/21
Permits Required? (list):	No	Work Location:	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☐ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Nitrile or Leather ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Camera Hand Tools

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
1. Exterior Inspection of SSDS/VIMS	1a. Sprains to ankle or broken bones due to slips, trips, falls during inspection	3	1a. Be attentive and aware of surroundings while inspecting the mitigation system. • Scan walking path and work area for trip hazards (uneven surface, ice/mud…) • Walk slowly and pay attention to footing (walking is working) and surfaces.	2 3
	1b. Skin rash or allergic reaction due to contact with poisonous plants	6	1b. Identify poisonous plant in immediate work area. • **STOP WORK** and communicate the identification of poisonous plants to team and PM. • Don safety glasses and leather gloves, upgrade to Tyvek suite to maximize protection.	
	1c. Allergic reaction due to contact with insects	4	1c. Do not approach and / or vacate area if insect infestation present. • Visual inspection from distance if necessary. Perform insect check post-inspection. • Utilize specific insect repellent (poison) or have professional called to remove nest. Call supervisor before using spray	2
	1d. Physical threat due to contact with owners/tenants	8	1d. Make contact with tenant/owner prior to entering exterior portion of property to ensure presence is known. • No Lone Worker without approval from PM or HSSE • Wear high-visibility PPE to be visible. Leave immediately if a threat present. • Be aware of facility vehicular traffic	4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Inspection of Sub-Slab Depressurization System / Vapor Intrusion Mitigation System	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
	1e. Bites or scratches to hands, arms or legs due to contact with domesticated pet(s)	8	1e. Ensure that owner/tenant pet(s), if present, have been secured and/or removed from the area. • Leave area immediately if pet(s) not secured, do not approach, and do not attempt pet/ play with pets! • Be aware of surroundings and know that an unsecured pet, whether belonging to the owner or not, can be a hazard.	4
On-Site Edits:				
2. Interior Inspection of SSDS/VIMS	2a. Physical threat due to contact with owners/tenants	8	2a. Ensure that all residences are aware of presence inside of home / basement. • Be professional and polite, answer questions to the best of knowledge. Leave immediately if threat sensed or present. • Be aware of surroundings and all exit points. • Be aware of facility vehicular traffic	4
	2b. Allergic reaction due to contact with insects (fleas and bedbugs)	4	2b. Discuss with owner before using chemical insect repellants (option-citrus based repellants). • Scan area for sign of insects (cleanliness, damp or dark areas within home…) upon entry and exit to ensure a possible infestation is quickly identified and treated. • If historical evidence of past infestations known then perform exterior inspection only, do not enter interior. • Conduct inspections of person and tools/equipment to ensure no insects.	2
	2c. Bites or scratches to hands, arms or legs due to contact with domesticated pet(s)	8	2c. Explain to tenant/owner that entry is required and to secure all animals away from work / inspection area. • Leave area immediately if pet(s) not secured, do not approach, and do not attempt pet/ play with pets! • Be aware of surroundings and know that an unsecured pet, whether belonging to the owner or not, can be a hazard. • Request exterior inspection of refusal to secure pet(s) is ignored.	4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Inspection of Sub-Slab Depressurization System / Vapor Intrusion Mitigation System	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

	Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
On-Site Edits:					

Additional Notes:

Task Hazard Assessment

AECOM Imagine it. Delivered.

All Employees:

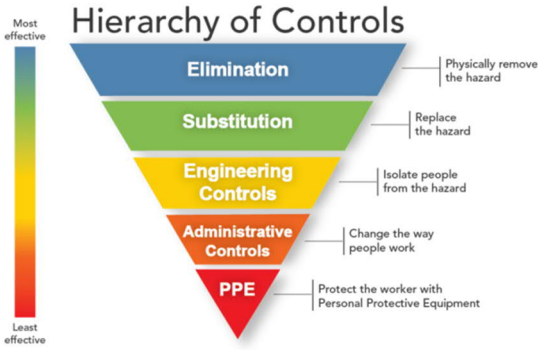
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
1. Supervisor:	
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Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
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Submit a new THA for addition to the DCSA THA Library or send THA improvement suggestions to DCSA.THA.Library@AECOM.com
Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Land Survey – At-Grade**	**Control #:**	**01-01-10-06**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	**BP**	**Date:**	**7/28/21**
Permits Required? (list):	**No**	**Work Location:**	**Columbia Cement site**		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather/mechanic ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Survey Equipment Hammer Stakes/pins

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Setup and use typical survey equipment	1a. Straining back or other parts of body due to improperly lifting or moving heavy objects	4	1a. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from over the side of the truck bed	2
	1b. Bruising or broken bone in finger due to getting caught in a pinch point in the survey equipment.	4	1b. Avoid placing hands near the sides or bottom of the tailgate. Ensure no other workers have their hands near the pinch points and that hands should be all clear. Carefully use the survey equipment watching for pinch points. Wear leather or Kevlar gloves	3
	1c. Straining, tearing or fracturing body parts from slipping, tripping or falling from carrying too much equipment at one time	4	1c. Do not try to carry too much. If you are carrying something over your shoulder and in both hands, you are at a much greater chance to trip and cannot catch yourself. Make multiple loads or get assistance. Team-lift anything over 50 lbs.	2
	1d. Straining a wrist, arm or neck or sustaining other ergonomic injury due to prolonged survey work	4	1d. Survey work can be repetitive – stretch regularly and report ergonomic injuries (strain, etc) as soon as you notice them.	3
	1e. Injury or illness caused by unwanted contact with various animals, insects, or other biological hazards	4	1e. There are many different types of biological hazards that can be encountered on a work site. These include ticks, spiders, mosquitoes, small mammals, bird droppings, snakes, etc. Consult S3AM-313-PR1 and the multiple attachments to determine the biological hazards that may be present and the mitigation measures for each.	3

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	1f. Sunburn caused by over-exposure to direct sunlight	4	1f. Have sunblock available and apply and reapply as per directions. Avoid direct solar exposure when possible. Seek breaks in shaded areas	2
On-Site Edits:				
2. Hammering stakes/nails/benchmarks into ground	2a. Sustaining serious personal injury or utility damage from contacting nearby utilities	8	2a. Ensure subsurface clearance protocol and permit requirements are being followed (in many states one-call must be performed before driving benchmarks – which can be 36 inch long- into ground) before beginning work. If a utility, pea gravel, or non-native fill material is encountered, **STOP WORK** and call the PM	3
	2b. Straining back or pulling other muscles from repetitive hammering action	4	2b. Do not turn at waist, turn with arms and shoulders and keep both feet square. Be mindful to take breaks and rotate shifts.	3
	2c. Pinching hands or developing blisters from improper use of hammers and other equipment.	4	2c. Note line of fire and position hands where you cannot get struck by the hammer. Pay attention to the task at hand and avoid distractions. Wear gloves to avoid blisters and reduce chance of injury.	2
	2d. Eye injury due to flying debris	4	2d. Inspect tools and stakes/pins for chips, burs, and "mushrooming". Ensure no one is standing within 10' of your work area. Wear safety glasses when using the hammer to prevent flying debris from hitting eyes	2
On-Site Edits:				
3. Working near roadway	3a. Sustaining critical injuries caused by being struck by oncoming vehicles	**15**	3a. Place "Surveyor Ahead" signs when possible. Work outside guardrail whenever possible. Keep AECOM vehicle parked between you and oncoming traffic, with wheels pointed away from road, and all flashing lights on. Place cones between traveled way, and you. If working adjacent to high-speed roadway (55 mph or above), you MUST have a spotter who is observing traffic at all times. Wear high-visible vest.	4
On-Site Edits:				

Task Hazard Analysis

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REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
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4.	4a.		4a.	
On-Site Edits:				
5.	5a.		5a.	
On-Site Edits:				
6.	6a.		6a.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

All Employees:

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Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

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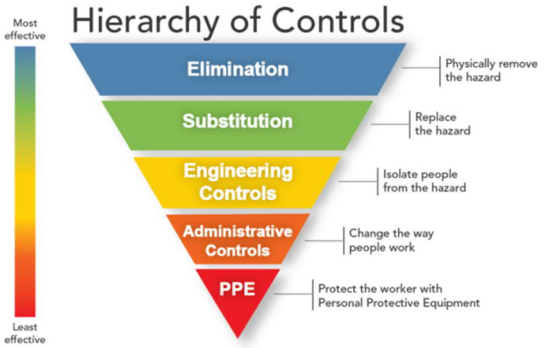

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Visitors review task hazards and acknowledge understanding
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Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Monitoring Well Abandonment – Grout**	**Control #:**	**01-01-05-03**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	**BP**	**Date:**	**7/29/21**
Permits Required? (list):	**No**	**Work Location:**	**Columbia Cement site**		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, Cut resistant, chemical ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Hand tools Grout pump

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Remove concrete pad with hand tools	1a. Injury from tool use	6	1a. Look around and behind you before starting. • Inspect tools prior to use. Broken or worn tools should be repaired or replaced. Use tools for their intended purpose to avoid unexpected failure. • Do not swing or apply tool (sledge hammer, shovel, digging bar) until area is free of bystanders. • Do not use extreme force. Use controlled motions and avoid having prying tool "break free". • Don all required PPE	3
	1b. Slips, trips, and fall injuries	6	1b. . Practice good housekeeping and frequently clear concrete debris. Keep unused tools off the ground. Do not carry debris long distances for disposal; if possible, park support vehicles in close proximity to well.	3
	1c. Eye or body injury from flying debris	8	1c. Maintain 25' distance when breaking up concrete pad. Wear safety glasses	3
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Monitoring Well Abandonment – Grout**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
2. Mix grout	2a. Injury to back or strain from lifting and mixing and moving equipment	8	2a. Lift with legs and not back. Do not reach or twist when lifting. Team-lift anything over 50 lbs. Make sure you have a clear path to where you are going before you carry heavy objects over distance	4
	2b. Inhalation of airborne particulates	4	2b. Stay upwind and wear dust mask while mixing grout. Pour grout slowly.	2
	2c. Hand injury from tools used to open bags	6	2c. Use scissors or safety cutters to open grout bags. Fixed open blade knives are not allowed to be used. Cut away from yourself and others. Inspect tools prior to use. Use cut-resistant gloves.	4
	2d. Eye or skin irritation from contact with grout	4	2d. Use tools to mix grout. Add water slowly to avoid splashing. Wear safety glasses and chemical-resistant gloves.	2
On-Site Edits:				
3. Fill well annulus or perforated well with grout	3a. Eye or skin irritation from contact with grout	4	3a. Avoid contact with grout. Wear safety glasses and chemical-resistant gloves.	3
	3b. Contact injury from pressurized hose or tremie pipe failure	6	3b. Inspect hose connections for wear and damage prior to pressurization and pumping grout. Inspect tremie pipe at connections and verify that there are no obstructions in tremie pipe prior to pumping grout. Wear safety glasses and chemical resistant gloves.	2
	3c. Slips, trips, and falls due to obstructions and slippery work area conditions	6	3c. Maintain clean work area free from trip hazards, such as hoses intersecting walking paths. Clean up any splashed or spilled grout immediately.	3
On-Site Edits:				
4. Debris handling and disposal	4a. Cuts and abrasions and pinch points during debris handling	6	4a. Note pinch points and sharp edges on concrete, well vaults, protective casings, metal skirts, and bollard debris and avoid. Don leather gloves	4

Task Hazard Analysis

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Task Name:	**Monitoring Well Abandonment – Grout**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
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	4b. Ergonomic Injury from lifting heavy objects	8	4b. Stretch before working. Bend at knees and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds	4
On-Site Edits:				
5. Site restoration	5a. Ergonomic Injury from lifting heavy bagged materials	8	5a. Inspect bags prior to lifting and carrying heavy bags of topsoil, concrete, or asphalt patch material. Stretch before working. Bend at knees and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds	4
	5b. Injury or property damage from stepping or driving into open holes or fresh fill areas	6	5b. Restore areas as soon as practical to avoid leaving open holes. Use traffic control devices, as needed, to prevent vehicles or pedestrians from contact with open holes or newly restored areas	3
	5c. Contact with patch materials and dust	4	5c. Avoid creating and breathing dust. Pour from upwind side of hole. Open bag and pour slowly in well ventilated area. Wear goggles/spoggles and leather gloves when handling materials	2
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Abandonment – Grout	Error! Reference source not found.

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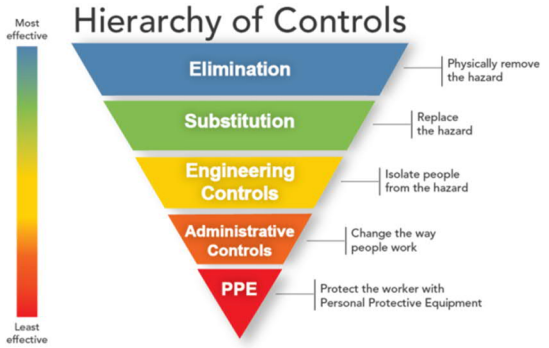

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Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
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Task Hazard Analysis

Task Name:	Monitoring Well Abandonment – Grout	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Monitoring Well Abandonment (Overdrilling)**	**Control #:**	**01-01-05-04**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/26/21
Permits Required? (list):	**No**	**Work Location:**	**Columbia Cement site**		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Cut Resistant, ☒ Hearing Protection ☐ Other:			
Tools & Equipment:	First Aid Kit PID	Spill Kit Decon Supplies	Fire Extinguisher Hand Tools	Traffic cones or other suitable barrier

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Contact One-Call, private utility contractor, and/or site personnel to locate and mark underground utilities.	1a. Striking unidentified underground utilities could result in explosion, electrocution, injury, death, property damage.	**10**	1a. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location.	4
On-Site Edits:				
2. Unload equipment	2a. Cuts or hand injuries from pinch points	6	2a. Inspect equipment for damage and sharp edges, replace all broken or damaged equipment. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools	2
	2b. Back strain/ overexertion when unloading equipment	6	2b. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from the side of the truck bed.	2
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Abandonment (Overdrilling)	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
3. Set up work zone	3a. Struck by vehicle or equipment traffic	8	3a. Establish work zone using traffic control devices, signs, cones, etc. in advance of initiating monitoring well abandonment activities. Restrict access to observers and passersby.	4
	3b. Slip, Trip or Fall injury	6	3b. Maintain good housekeeping in work area, do not carry equipment where visibility of ground is impaired, remove or mark all trip hazards in work area.	2
On-Site Edits:				
4. Remove concrete pad (if required)	4a. Improper tools for task.	6	4a. Inspect tools prior to use. Broken or worn tools should be repaired or replaced. Use tools for their intended purpose to avoid unexpected failure.	2
	4b. Injury from tool use	8	4b. Wear cut/impact resistant gloves when using hand tools. Do not swing or apply tool (sledge hammer, digging bar) until area is free of bystanders. Look around and behind you before starting. Avoid applying extreme pressure to digging bar such that it flexes out of shape; it could suddenly release potential energy which could throw you off your feet.	4
	4c. Airborne debris	6	4c. Observers should maintain adequate distance when breaking up concrete pad. Wear safety glasses.	2
	4d. Noise	6	4d. Wear hearing protection while equipment is in use.	2
On-Site Edits:				
5. Position drill rig over pre-cleared borehole in position to tower up mast	5a. Struck-by, crushed-by, caught-by drill rig.	**10**	5a. Communicate path of movement to all project personnel. Establish and use agreed upon hand signals during spotting activities. Always use a spotter(s) to direct movement of drill rig and watch for vehicle and pedestrian traffic. Additional spotter(s) will be used in high traffic areas and in areas with blind spots where traffic is difficult to observe.	4
	5b. Contact with overhead utilities.	**10**	5b. Keep a minimum of 15 feet from overhead power lines (20 ft. if 230-285 KV, 25 ft. if 285-345 KV, 35 ft. if 345-500 KV) Check HASP to ensure client/site does not have stricter requirements.	4
	5c. Slip, trip, and fall (STF) hazards from uneven terrain, slick surfaces	8	5c. Check walking/movement path for STF obstructions. Conduct pre-site walk with crew prior to drilling and remove or isolate STF hazards.	4
		10		

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Abandonment (Overdrilling)	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
	5d. Hydraulic failure causing injection injury or release to the environment.		5d. Place secondary containment on ground under rig. Ensure that secondary containment is setup with 'berms/barriers' or containment is securely clipped onto the rig tracks/wheels to protect from any fluid leaking off the plastic. Inspect hydraulic lines. Look for leaks with piece of wood or cardboard – never a body part.	3
On-Site Edits:				
6. Over drill well	6a. Pinch points 6b. Entanglement causing severe injury/amputation 6c. 6d. Hearing loss from noise 6e. Back strain/ overexertion when unloading equipment	6 **10** 6 8	6a. Never place hands, fingers, feet under the bottom of an auger flight, or other location where these heavy items could be set down or could fall suddenly. 6b. Ensure rotating parts are properly guarded. Remove loose clothing and jewelry that could become entangled in moving parts. Use a long handled shovel to remove cuttings from the auger. 6c. Wear hearing protection while equipment is in use. 6d. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from the side of the truck bed.	2 4 2 4
On-Site Edits:				
7. Mixing and pumping grout	7a. Injury to back or strain from lifting and mixing, moving equipment (wheel barrel), cuts/lacerations. 7b. Inhalation of airborne particulates 7c. Pressurized hose or tremie pipe failure	8 6 8	7a. Use buddy system when lifting materials >50 pounds. Use proper lifting techniques (lift with your legs and arms, not back). Do not reach or twist when lifting. Make sure you have a clear path to where you are going before you carry heavy objects over distance. 7b. Stay upwind and wear dust mask while mixing grout. 7c. Inspect hose connections for wear and damage prior to pressurization and pumping grout. Inspect tremie pipe at connections and verify that there are no obstructions in tremie pipe prior to pumping grout. Use whip -checks on all pressurized lines.	4 2 4

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Abandonment (Overdrilling)	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!					
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On-Site Edits:					

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Abandonment (Overdrilling)	Control #:	Error! Reference source not found.

All Employees:

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- ***What am I about to do?***
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- ***What can be done to make it safer?***
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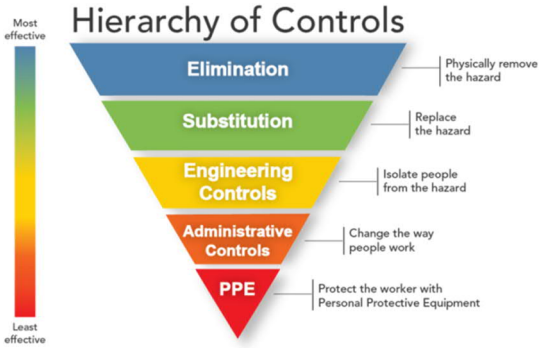
For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
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Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
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Task Hazard Analysis

Task Name:	Monitoring Well Abandonment (Overdrilling)	Control #:	Error! Reference source not found.

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Well Abandonment	Control #:	01-01-03-08

Project Name:	BP-IPO Columbia Cement	Client:	BP	Date:	7/28/21
Permits Required? (list):	No	Work Location:	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Cut Resistant, ☒ Hearing Protection ☐ Other:
Tools & Equipment:	First Aid Kit; Spill Kit; Fire Extinguisher; Hand Tools; Traffic cones or other suitable barrier

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
1. Contact One-Call, private utility contractor, and/or site personnel to locate and mark underground utilities.	1a. Failure to have underground utilities identified could result in explosion, electrocution, injury, death, property damage.	10	1a. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location.	1
On-Site Edits:				
2. Unload equipment	2a. Cuts or hand injuries from share edges of cutting tools	6	2a. Inspect equipment for damage and sharp edges, replace all broken or damaged equipment. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points	2
	2b. Back strain/ overexertion when unloading equipment	6	2b. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from the side of the truck bed.	2
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Well Abandonment	Control #:	Error! Reference source not found.**01-01-03-08**

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
3. Set up work zone	3a. Broken bones due to contact with vehicle or equipment traffic	8	3a. Establish work zone using traffic control devices, signs, cones, etc. in advance of initiating monitoring well abandonment activities. Restrict access to observers and passersby. Don hi-visible vest.	4
	3b. Sprains, strains or broken ankles or legs due to slip, trip or fall	6	3b. Maintain housekeeping in work area, do not carry equipment where visibility of ground is impaired, remove or mark all trip hazards in work area. Plan travel path to avoid changes in surface.	2
On-Site Edits:				
4. Remove well pad & manway	4a. Injury to body due to underground Utility Strike	**10**	4a. Ensure area of well pad was cleared during underground utility clearance procedure as well as overhead hazards with the drill rig. Verify utilities and the need for any LOTO requirements.	4
	4b. Sprains or strains to back or shoulders during jack hammer use	6	4b. Take breaks from utilizing jackhammer or other hand tools to break out manway. Do not lift anything over 50 lbs. without assistance (partner or appropriate mechanical device). Use proper lifting techniques, lift with legs, keep back straight, and carry object close to body. Don leather gloves, safety glasses, hard hat and hearing protection.	2
	4c. Cuts or contusions to face due to contact with debris	6	4c. When jackhammering, ensure area of debris throw is clear from people or objects. If in area of shoveling, do not approach technician using jackhammer unless they acknowledge you and stop working. Don leather gloves, safety glasses, hard hat and hearing protection.	2
On-Site Edits:				
5. Perforate Casing to Total Depth	5a. Cuts or contusions to hands, fingers or other body parts due to contact with drill rig hammering	8	5a. Keep fingers and other body parts away from hammer, watch for jumping/shifting of the rig, work in area where other employees will not enter. Wear cut-resistant gloves.	4
				4

Task Hazard Analysis

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Task Name:	Well Abandonment	Control #:	Error! Reference source not found.**01-01-03-08**

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	5b. Hand injury manipulating rods for perforation process	8	5b. Watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools. Wear impact resistant gloves at all times	
On-Site Edits:				
6. Backfilling & surface restoration	6a. Exposure to cement dust and mixed cement and asphalt (eye, and inhalation irritation) 6b. Back or muscle strain due to over exertion	6 6	6a. Refer to the SDS for use information. Mix upwind. Wear long sleeved shirt, long pants, gloves, and safety glasses. Wear a P, N, or R-95 dust respirator when dealing with dry cement (moving bags, pouring, mixing, and putting bags in trash). 6b. Keep shovel loads and twisting motions to a minimum. Do not lift anything over 50 lbs. without assistance (partner or appropriate mechanical device). Use required lifting techniques, lift with legs, keep back straight, and carry object close to body. Don leather gloves.	2 2
On-Site Edits:				
7.	7a.		7a.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

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Task Name:	Well Abandonment	Control #:	Error! Reference source not found.**01-01-03-08**

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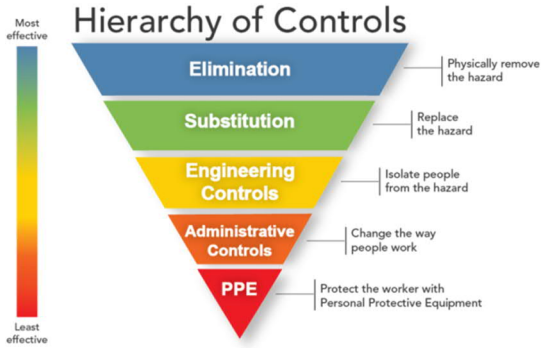

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Task Hazard Analysis

Task Name:	Well Abandonment	Control #:	Error! Reference source not found.**01-01-03-08**

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Monitoring Well Construction	Control #:	01-01-05-05

Project Name:	**BP-IPO**	**Client:**	**BP**	**Date:**	**7/26/21**
Permits Required? (list):	**No**	**Work Location:**	**Columbia Cement site**		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	X Hard Hat X Safety Glasses X HiVis Vest X Safety Toe Boots X Gloves: _____ ☐ Hearing Protection ☐ Other: _____			
Tools & Equipment:	First Aid Kit Hand tools	Fire Extinguisher	Decon Supplies	4-gas multi-meter

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
1. Contact One-Call, private utility contractor, and/or site personnel to locate and mark underground utilities.	1a. Failure to have underground utilities identified could result in explosion, electrocution, injury, death, property damage.	**10**	1a. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location.	4
On-Site Edits:				
2. Unload equipment	2a. Cuts or hand injuries from pinch points	6	2a. Inspect equipment for damage and sharp edges, replace all broken or damaged equipment. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools	2
	2b. Back strain/ overexertion when unloading equipment	6	2b. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from the side of the truck bed.	2
On-Site Edits:				

Task Hazard Analysis

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3. Set up work zone	3a. Struck by vehicle or equipment traffic	8	3a. Establish work zone using traffic control devices, signs, cones, etc. in advance of initiating monitoring well abandonment activities. Restrict access to observers and passersby.	4
	3b. Slip, Trip or Fall	6	3b. Maintain good housekeeping in work area, do not carry equipment where visibility of ground is impaired, remove or mark all trip hazards in work area.	2
On-Site Edits:				
4. Position drill rig over pre-cleared borehole in position to tower up mast	4a. Struck-by, crushed-by, caught-by drill rig.	**10**	4a. Communicate path of movement to all project personnel. Establish and use agreed upon hand signals during spotting activities. Always use a spotter(s) to direct movement of drill rig and watch for vehicle and pedestrian traffic. Additional spotter(s) will be used in high traffic areas and in areas with blind spots where traffic is difficult to observe.	4
	4b. Contact with overhead utilities.	**10**	4b. Keep a minimum of 15 feet from overhead power lines (20 ft. if 230-285 KV, 25 ft. if 285-345 KV, 35 ft. if 345-500 KV) Check HASP to ensure client/site does not have stricter requirements.	4
	4c. Slip, trip, and fall (STF) hazards from uneven	8	4c. Check walking/movement path for STF obstructions. Conduct pre-site walk with crew prior to drilling and remove or isolate STF hazards.	4
	4d. Hydraulic failure causing release to the environment.	**10**	4d. Place secondary containment on ground under rig. Ensure that secondary containment is setup with 'berms/barriers' or containment is securely clipped onto the rig tracks/wheels to protect from any fluid leaking off the plastic.	3
On-Site Edits:				
5. Commence drilling	5a. Pinch points	6	5a. Never place hands, fingers, feet under the bottom of an auger flight, or other location where these heavy items could be set down or could fall suddenly.	2
	5b. Entanglement	**10**	5b. Ensure rotating parts are properly guarded. Remove loose clothing and jewelry that could become entangled in moving parts. Use a long handled shovel to remove cuttings from the auger.	4
	5c. Noise	6	5c. Wear hearing protection while equipment is in use.	2

Task Hazard Analysis

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	5d. Back strain/ overexertion when unloading equipment	8	5d. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds.	4
On-Site Edits:				
6. Well Casing Assembly and Installation	6a. Muscle strain. 6b. Slip, trip, and fall (STF) hazards from uneven 6c. Injury from improper tool use. 6d. Dust inhalation. 6e. Cutting PVC, cuts, lacerations 6f. Exposure to airborne chemicals or explosive atmosphere 6g. Crushed by, pinch point on drill rig	8 8 8 6 8 8 **10**	6a. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. 6b. Check walking/movement path for STF obstructions. Conduct pre-site walk with crew prior to work and remove or isolate STF hazards. 6c. Do not use tools for unintended purposes (such as a saw to open bags of bentonite instead of an approved cutting tool). 6d. Wear a dust mask and minimize dust when pouring powdered bentonite, concrete, or cement. 6e. Use PVC cutter for cutting PVC. Wear cut-resistant gloves (Level 2), keep fingers and other body parts away from cutting tool blade. 6f. Conduct air monitoring with PID and 4-gas in background areas and breathing zone of all workers, Stop work if PID or LEL indicates action level, Wear respirator with organic vapor cartridge if VOCs cannot be controlled. 6g. Keep body parts away from moving parts on drill rig.	4 4 3 2 3 4 4
On-Site Edits:				
7. Installation of sand filter pack/bentonite	7a. Injury form cutting bags open 7b. Eye and respiratory injury due to dust and other airborne particles 7c. Back or muscle strain due to improper load or lifting techniques	8 6 8	7a. Use a safety knife. No fixed-blade knifes allowed on site. Wear minimum Level 2 cut-resistant gloves. Cut away from the body 7b. Refer to the SDS for use information. Wear long sleeved shirt, long pants, gloves, and safety glasses. Wear a P, N, or R-95 dust respirator when dealing with quartz sand (moving bags, pouring, mixing, and putting bags in trash). 7c. Do not lift anything over 50 lbs. without assistance (partner or appropriate mechanical device). Use proper lifting techniques, lift with legs, keep back straight, and carry object close to body.	4 2 4

Task Hazard Analysis

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On-Site Edits:				

Additional Notes:

Task Hazard Analysis

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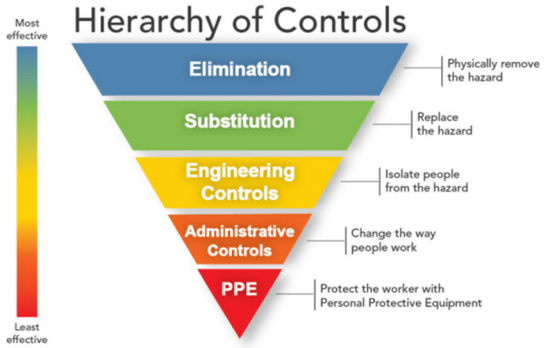

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Task Hazard Analysis

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Monitoring Well Pad Replacement**	**Control #:**	**01-01-05-09**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/26/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather, nitrile ☒ Hearing Protection ☒ Other: Face shield/goggles, Particulate dust mask
Tools & Equipment:	Jackhammer Concrete Wheel chocks

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Set up air compressor and equipment	1a. Overturn the air compressor	3	1a. Check to see that ground is stable and level enough to support the air compressor.	2
	1b. Vehicle collision, Unexpected vehicle or equipment movement	**15**	1b. Stand clear of moving vehicles, use spotter to direct driver. Communicate with others working in area when moving air compressor to prevent striking others. Properly hitch air compressor to vehicle before relocating. Once air compressor is in position, **place wheel chocks behind wheels to prevent unexpected movement**.	4
On-Site Edits:				
2. Remove concrete pad with jack hammer and hand tools	2a. Injury from moving heavy loads	9	2a. Use a buddy to move jack hammer.	4
	2b. Slips, trips, and falls	6	2b. Practice good housekeeping; keep air compressor hoses out of walking paths and frequently clearing concrete debris.	2
	2c. Struck by airborne debris	8	2c. Jack hammer operator must use face shield to protect face from debris while operating equipment. Observers must stand outside established work zone. Wear safety glasses and hard hats to protect against airborne debris from jack hammer or hand tool use.	3
	2d. Struck by hand tools	9	2d. Look around and behind you before swinging sledge hammer to avoid striking others.	4

Task Hazard Analysis

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	2e. Release of stored energy in digging bar resulting in fall or struck by injury (bar or concrete pad)	9	2e. Avoid placing excessive pressure on digging bar when prying out concrete pad (bending the bar) as this could suddenly release stored energy.	4
	2f. Dust inhalation	5	2f. Maintain upwind positioning while operating jack hammer. If excessive dust, wear particulate dust mask to avoid breathing dust.	2
	2g. Exposure to noise	5	2g. Operator and observers must wear hearing protection during jack hammer operations.	2
	2h. Burns	9	2h. Beware of hot surfaces inside compressor housing. Wear leather gloves when touching compressor components.	4
On-Site Edits:				
3. Mix concrete	3a. Injury to back or strain from lifting and mixing, moving equipment (wheel barrel), cuts/lacerations	8	3a. Use buddy system when lifting materials >50 pounds. Use proper lifting techniques (lift with your legs and arms, not back). Do not reach or twist when lifting. Make sure you have a clear path to where you are going before you carry heavy objects over distance.	4
	3b. Inhalation of airborne particulates	5	3b. Stay upwind and wear dust mask while mixing concrete.	2
	3c. Hand injury	9	3c. Use proper tools to open concrete bags and mix concrete. Inspect tools prior to use. Wear leather gloves.	2
On-Site Edits:				

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4. Pour concrete pad	4a. Muscle strain	8	4a. Use two people to move heavy well materials to avoid muscle strain or back injury.	4
	4b. Slips, trips, and falls	6	4b. Maintain a clear path when moving well materials from the support vehicle to the drill rig.	2
	4c. Injury from improper tool use	9	4c. Do not use tools for unintended purposes (such as a saw to open bags of concrete instead of an approved cutting tool).	2
	4d. Dust inhalation	5	4d. Wear a dust mask and minimize dust movement when pouring powdered concrete.	2
On-Site Edits:				
5. Mark position of completed well pad and isolate from traffic	5a. Exposure to vehicles	6	5a. Mark wet concrete well pads with cones or other barricades to alert passersby and vehicles to avoid striking newly completed well pad.	2
On-Site Edits:				
6. Debris handling and disposal	6a. Cuts and abrasions and pinch points during debris handling	6	6a. Wear leather gloves when handling debris. Be aware of pinch points and rough and sharp edges on concrete.	2
	6b. Injury from lifting heavy objects	8	6b. Use more than one person to lift/move heavy (>50 lbs.) debris.	4
On-Site Edits:				

Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

Additional Notes:

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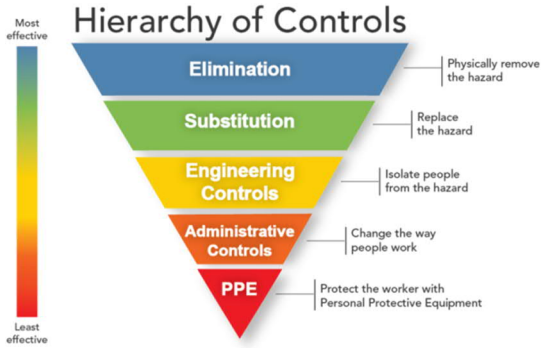

- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
1. Supervisor:	
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Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
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Task Hazard Analysis

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Site Walk – General Site Visit	**Control #:**	01-01-10-06

Project Name:	**BP**	**Client:**	BP-IPO Colubia Cement	**Date:**	7/26/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: leather ☒ Hearing Protection ☐ Other: PPE for expected weather conditions
Tools & Equipment:	camera notebook/pen

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Plan the site walk	1a. Personal injury from not having proper PPE	4	1a. Determine what the basic PPE requirements are in advance and have available or know that they will be available to you to borrow once on site.	4
	1b. Vehicle getting stuck or damaged due to terrain/site conditions	4	1b. Determine what type of vehicle is needed for site conditions (4-wheel drive, truck or car).	4
	1c. Heat/cold stress, insect bites, sunburn from inadequate materials/supplies	4	1c. Determine what materials and supplies you must bring versus what is available on site such as insect spray, sunscreen, drinking water, food, etc.	4
	1d. Lack of site escort if needed	4	1d. Prearrange trip in advance where possible, determine who will be meeting you on site and when.	4
	1e. Inclement weather	6	1e. Plan for the anticipated weather conditions. Check the predicted weather for the worksite prior to departing. Reschedule site visit if severe weather such as lightning storms, sleet/ice storms, blizzards, etc., are predicted.	2
On-Site Edits:				
2. Arriving at site	2a. Getting stuck or sustaining slip/trip/fall injuries from parking in inappropriate areas	6	2a. Know where you are supposed to park prior to arrival or check in at site. Park in an area with firm, level surface, and with a good surface (avoiding wet/muddy conditions, poor walking surfaces, etc) available when you exit the vehicle.	2

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found. **Site Visit**	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	2b. Injuries from being struck due to 3rd party or client operations	**10**	2b. Park that you do not subject yourself or your vehicle to site hazards such as construction vehicle traffic, forklifts or other equipment, passing motorists, etc, ,	2
On-Site Edits:				
3. Walking Site/Observing Work	3a. Biological hazards	4	3a. There are many different types of biological hazards that can be encountered on a work site. These include ticks, spiders, mosquitoes, chiggers, poisonous or other noxious plants, alligators, bears, small mammals, bird droppings, small mammals, snakes, etc. Do not attempt to pick up, handle, or otherwise handle stray or wild animals such as dogs, cats, raccoons, squirrels, etc., no matter how tame they may appear.	2
	3b. Slips/trips/falls	4	3b. Be aware of walking surfaces at all times, wear footwear with good tread and ankle support, use handrails where available, avoid walking in muddy or wet areas when possible, identify and mark or have removed any obstructions that may be present in predicted walking paths.	2
	3c. Crossing roads, bridges, etc	6	3c. Keep to pathways appropriate for pedestrian traffic – sidewalks, walkways with handrails, etc. If no sidewalk is present, stay off the side of the shoulder, behind guardrails where possible, etc. Walk facing traffic. Never take photographs while walking to reduce risk of inadvertently wandering into traffic.	3
On-Site Edits:				
4. Leaving the site	4a. Transporting biological hazards into vehicle	4	4a. Inspect self for ticks before entering vehicle. If it possible that clothing and personal items such as jackets, backpacks, lunch bags, and so on have been exposed to poisonous plant oils or may harbor ticks or other insects, bag such items until they can be appropriately treated.	2
	4b. Hitting object when leaving causing vehicle or property damage	6	4b. Before moving the vehicle, perform a 360° walk around of the vehicle to verify that no changes have been made that may impact exit.	4

Task Hazard Assessment

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REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
On-Site Edits:				
5.	5a.		5a.	
On-Site Edits:				
6.	6a.		6a.	
On-Site Edits:				
7.	7a.		7a.	
On-Site Edits:				

Additional Notes:

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found. **Site Visit**	Control #:	Error! Reference source not found.

All Employees:

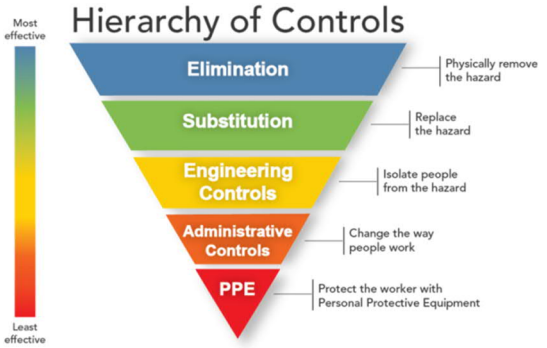
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



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Task Hazard Assessment

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Summa Canister Sampling**	**Control #:**	**01-01-22-04**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/26/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Leather ☐ Hearing Protection ☐ Other:
Tools & Equipment:	Summa canister Wrenches Tubing

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Set up equipment	1a. Muscle strain	6	1a. Use proper precautions (lift with legs, not back) when lifting equipment into/out of vehicle. If lifting >50 lbs, use the buddy system. Avoid twisting, stooping, and/or extended reaching positions when handling or moving equipment.	4
	1b. Equipment damage	3	1b. Use a solid work surface when assembling summa canisters to avoid dropping or damaging equipment. Work from the ground surface, floor, or the tailgate of the truck when applicable. Adhere to laboratory assembly instructions. Use correct size wrenches to connect fittings. Ensure wrenches are properly seated on fittings prior to loosening or tightening fittings.	2
	1c. Pinch points, lacerations	6	1c. Wear leather gloves to prevent hand injury in case the wrench slips off a fitting or while cutting tubing.	1
	1d. Tool/equipment failure caused by use	3	1d. Conduct physical inspection of all equipment. Worn or broken tools should be repaired or replaced.	1
On-Site Edits:				
2. Collect Sample	2a. Slips, trips, falls	6	2a. Maintain clean and organized work area; keep walking paths clear of equipment and debris.	3

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	2b. Injury from poor ergonomics	6	2b. Maintain proper body positioning/good ergonomic form. Avoid stooping and twisting.	2
On-Site Edits:				
3. Pack Sample Cooler	3a. Muscle strain	6	3a. Use proper lifting techniques (lift with legs, not back) and use buddy system if lifting items >50 pounds. Avoid twisting, stooping, and/or extended reaching body positions when moving full coolers.	2
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Error! Reference source not found.	Control #:	Error! Reference source not found.

All Employees:

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Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

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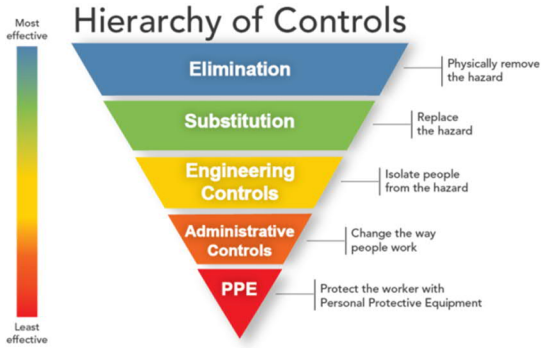

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Task Hazard Analysis

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Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	Traffic Control For Working Adjacent to a Roadway (Clear Zone)	**Control #:**	01-01-20-03

Project Name:	**BP-IPo Columbia Cement**	**Client:**	BP	**Date:**	7/26/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☐ Hard Hat ☐ Safety Glasses ☐ HiVis Vest, Class ___ ☐ Safety Toe Boots ☐ Ear Plugs/Muffs NRR____ ☐ Gloves: Leather/HiVis ☐ Other:
	☐ Side Impact Helmet ☐ HiVis Vest Clothing, Class E ☐ Personal light ☐ Hearing Protection ☐ Other: _____
Tools & Equipment:	☐ Temporary Traffic Control Devices per Traffic Control Plan ☐ Personal ☐ Warning signs ☐ Cones ____" ☐ 4-Way Beacon (Vehicle) ☐ Insect repellent ☐ Sunscreen ☐ Rain Gear (Class E) ☐ Shade ☐ Safety Whistle ☐ Portable lighting for work area, light meter

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Pull off roadway to shoulder or beyond shoulder	1a. Critical injuries caused by vehicle collision upon slowing onto secure location.	15	1a. Activate vehicle warning lights and begin slowing vehicle early.	4
	1b. Critical injuries caused by being struck from behind when parked on the shoulder or further.	15	1b. Do not pull over where rear view visibility is poor (curves, overhead obstructions, trees etc.). Select area with enough room to exit the vehicle and have an emergency escape route for errant vehicles. Set parking brake and keep seatbelt on at all times, even when parked.	4
	1c. Vehicle damage from getting stuck in mud or being on steep slopes	15	1c. Observe ground cover and obstructions on shoulder and avoid steep or muddy conditions. Set your parking brake and turn your wheels away from the direction of the slope.	4
On-Site Edits:				
2. Exiting the vehicle upon parking	2a. Sustaining critical injuries caused by being struck by moving traffic while exiting the vehicle.	15	2a. Observe traffic flow prior to exiting the vehicle. Exit vehicle when there is a break in traffic. Walk toward rear of vehicle, watch oncoming traffic. Walk immediately to protected side of vehicle and access tools and equipment from protected side. Never stand directly in front of vehicle, leave minimum 50ft of buffer between you and the front of the vehicle.	8
	2b. Straining back or other lower body injury caused by unsafe	8	2b. Assess the terrain, slopes greater the 30 degrees require fall protection. Assess work area for unprotected ledges or parapet style walls that are less than 42" require	3

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Traffic Control For Working Adjacent to a Roadway (Clear Zone)	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
	terrain, loose footing, slips or falls.		additional fall protection if fall distance is greater than 4' or 6' depending on location.	
	2c. Injury or illness caused by unwanted contact with animals, insects or biological hazards.	4	2c. Avoid heavy brush/grass. Wear insect repellent and poisonous plant barrier creams, as well as disposable coveralls, gloves and boot covers.	2
On-Site Edits:				
3. Unload traffic control equipment from rear of work truck	3a. Critical injuries caused by being struck by moving traffic	**15**	3a. Continue warning lights/beacons. Face traffic, monitor general traffic patterns. Walk in protected areas where possible (behind guard rails). Leave an emergency egress route in case of an errant vehicle.	8
	3b. Bruising or broken finger due to getting caught in a pinch point in the vehicle or tailgate.	8	3b. Avoid placing hands near the sides or bottom of the tailgate and other collapsible parts of traffic control devices, tools, etc. Wear leather or Kevlar gloves.	4
	3c. Bruise, strain, or fracture to body from slip, trip or fall from carrying too much equipment at one time or uneven surfaces	8	3c. Never carry more than 4 cones, fewer if 4 could impede visibility or limits movement. Never lift more than you are capable of lifting safely, and use good body mechanics. Inspect your walking path to assure it is clear, notice any changes in walking surfaces and make adjustments to your gait to accommodate for changes.	4
On-Site Edits:				
4. Deploying temporary traffic control devices (cones and light weight signage)	4a. Critical injuries caused by being struck by moving traffic while deploying traffic control devices.	**15**	4a. Face and monitor moving traffic. Leave an emergency egress route in case of an errant vehicle. If you cannot maintain view of on-coming traffic stop work and obtain help from a spotter. Place traffic control in a sequence that offers greatest protection from moving traffic, typical the devices further from the work zone are placed first. Set-up may be adjusted to increase protection but TCP elements should never be removed of modified in a way that decreases protection.	8
	4b. Straining back or other parts of body due to improperly lifting or moving heavy objects.	4	4a. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck,	2

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Traffic Control For Working Adjacent to a Roadway (Clear Zone)	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
			slide the case to the tailgate and lift from tailgate, not over the side of the truck bed.	
On-Site Edits:				
5. Verifying traffic control set up	5a. Critical injuries caused by being struck by errant vehicle in the work zone.	**15**	5a. Maintain constant vigilance. Verify that all access roads drive ways, parking areas, emergency use areas with in the work zone are protected with TTCD.	8
	5b. Misdirection and confusion resulting in unsafe traffic conditions due to incorrect or insufficient set up of traffic control.	4	5b. Assure that the TTCD are spaced appropriate for the speeds of the motoring public, shorten distance between cones if speeds are slower than anticipated. Increase number of (and distance of) advance warning signs if drivers fail to yield or slow to traffic control set up.	2
	5c. Misdirection or confusion in work flow by unintended interaction with public in the work zone.	4	5c. Make verbal contact with other workers or the public in the areas to alert them to your presence and orientate them to the work zone. Do not rely on eye contact as a means of communication.	2
On-Site Edits:				
6.	6a.		6a.	
On-Site Edits:				

Task Hazard Analysis

Task Name:	Traffic Control For Working Adjacent to a Roadway (Clear Zone)	Control #:	Error! Reference source not found.

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Traffic Control For Working Adjacent to a Roadway (Clear Zone)	Control #:	Error! Reference source not found.

All Employees:

STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

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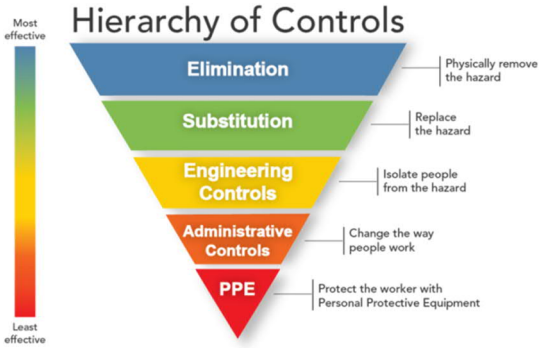

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Task Hazard Analysis

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Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Well Pad Construction**	**Control #:**	**01-01-05-06**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/26/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☒ Hard Hat ☒ Safety Glasses ☒ HiVis Vest ☒ Safety Toe Boots ☒ Gloves: Cut Resistant, ☒ Hearing Protection ☐ Other:
Tools & Equipment:	First Aid Kit; Spill Kit; Fire Extinguisher; Hand Tools; Traffic cones or other suitable barrier

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Contact One-Call, private utility contractor, and/or site personnel to locate and mark underground utilities.	1a. Failure to have underground utilities identified could result in explosion, electrocution, injury, death, property damage.	**10**	1a. Call public utility locating service prior to initiating work activities. Use private locating service to mark out areas on private property. Verify location of utility marks; do not perform intrusive work if utility location marks cannot be found or if marks are destroyed. Preserve utility marks as much as possible. Call to have utilities remarked if unsure as to their location.	1
On-Site Edits:				
2. Unload equipment	2a. Cuts or hand injuries from pinch points 2b. Back strain/ overexertion when unloading equipment	6 6	2a. Inspect equipment for damage and sharp edges, replace all broken or damaged equipment. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools 2b. Stretch before working. Bend and lift with legs and arms, not back. Team-lift any items that are awkward or over 50 pounds. If removing from the back of a truck, slide the case to the tailgate and lift from tailgate and not from the side of the truck bed.	2 2
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Well Pad Construction	Control #:	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	Potential Hazards *How could you be hurt? What would the injury be?*	Risk *(initial)*	Critical Actions To Mitigate Hazards *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	Risk *(final)*
3. Set up work zone	3a. Struck by vehicle or equipment traffic	8	3a. Establish work zone using traffic control devices, signs, cones, etc. in advance of initiating monitoring well abandonment activities. Restrict access to observers and passersby.	4
	3b. Slip, Trip or Fall	6	3b. Maintain good housekeeping in work area, do not carry equipment where visibility of ground is impaired, remove or mark all trip hazards in work area.	2
On-Site Edits:				
4. Excavating Well Pad Area	4a. Underground Utility Strike	**10**	4a. Ensure area of well pad was cleared during underground utility clearance procedure for well.	4
	4b. Back or muscle strain	6	4b. Keep shovel loads and twisting motions to a minimum. Do not lift anything over 50 lbs. without assistance (partner or appropriate mechanical device). Use proper lifting techniques, lift with legs, keep back straight, and carry object close to body.	2
	4c. Struck by shovel	6	4c. When shoveling, know area of shovel movement is clear from people or objects. Do not use shovel in the direction of people and objects. If in area of shoveling, do not approach shoveled area unless they acknowledge you and stop working.	2
On-Site Edits:				
5. Installing Well Pad Frame	5a. Cutting Wood Frame	8	5a. Wear cut-resistant gloves (Level 2), keep fingers and other body parts away from blade, watch for jumping of saw, work in area where other employees will not enter	4
	5b. Injury from assembling well frame	8	5b. Wear cut resistant gloves at all times and watch hand placement to avoid sharp edges and pinch points. Keep face, hands, fingers, and feet out of the line of fire of moving parts and tools	4
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Well Pad Construction**	**Control #:**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
6. Pouring and Troweling Concrete Pad	6a. Exposure to cement dust and mixed cement, skin, eye, and inhalation irritation. 6b. Back or muscle strain	6 6	6a. Refer to the SDS for use information. Wear long sleeved shirt, long pants, gloves, and safety glasses. Wear a P, N, or R-95 dust respirator when dealing with dry cement (moving bags, pouring, mixing, and putting bags in trash). 6b. Keep shovel loads and twisting motions to a minimum. Do not lift anything over 50 lbs. without assistance (partner or appropriate mechanical device). Use proper lifting techniques, lift with legs, keep back straight, and carry object close to body.	2 2
On-Site Edits:				
7.	7a.		7a.	
On-Site Edits:				

Additional Notes:

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Well Pad Construction	Control #:	Error! Reference source not found.

All Employees:

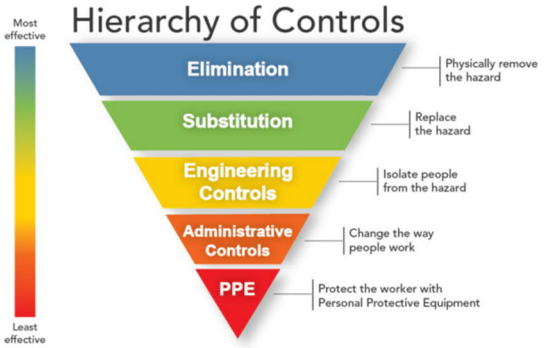
STOP WORK if uncertain about safety or if a hazard or additional precaution is not recorded on the THA.

Be alert, recognize and communicate any changes in scope, personnel or conditions at the worksite to the supervisor.

Use **4-Sight**, AECOM's last minute risk assessment process continuously throughout the day by asking yourself and your co-workers to assess your task, hazards, and mitigations. Amend the THA when needed.

- ***What am I about to do?***
- ***What can go wrong?***
- ***What can be done to make it safer?***
- ***What have I done to communicate the hazards?***

For a more thorough identification of hazards, ask "What else could go wrong?" using the Hazard Categories



- ***Most hazards need more than one control***
- ***What should you do? Stack your controls***
- ***PPE can NEVER be your only means of protection***

Worker Sign On	
I participated in the on-site review and fully understand the content of this Task Hazard Assessment.	
Printed Name	**Signature**
1. Supervisor:	
2.	
3.	
4.	
5.	
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10.	

Visitor Acknowledgement
Visitors review task hazards and acknowledge understanding
1.
2.
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8.
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10.

Submit a new THA for addition to the DCSA THA Library or send THA improvement suggestions to DCSA.THA.Library@AECOM.com

Task Hazard Analysis

Task Name:	Well Pad Construction	Control #:	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Task Hazard Assessment

AECOM Imagine it. Delivered.

Task Name:	**Working Over Water**	**Control #:**	**01-01-18-01**

Project Name:	**BP-IPO Columbia Cement**	**Client:**	BP	**Date:**	7/28/21
Permits Required? (list):	No	**Work Location:**	Columbia Cement site		

This THA must be fully reviewed with all staff members. All job steps, hazards, work practices, and PPE are clearly understood and have been implemented. All necessary revisions have been written on the THA.

Required PPE:	☐ Hard Hat ☒ Safety Glasses ☐ HiVis Vest ☐ Safety Toe Boots	☒ Gloves: Leather work gloves or mechanix style gloves	☐ Hearing Protection : ☒ Other— PFD, Float Coat, or Mustang Suit depending on temperature
Tools & Equipment:	PVC Pipe, Drill, Rope, Zip-ties		

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!

Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
1. Pre-work planning	1a. Unprepared for performing work	**15**	1a. Follow the requirements of S3AM-315-PR1, Work Over Water and S3AM-333-PR1, Marine Safety Operations **INCLUDING ALL APPLICABLE ATTACHMENTS.**	**10**
	1b. Untrained/unqualified Captain of vessel	**12**	1b. Verify that captain of vessel is fully qualified to operate the class of vessel to be deployed. he boat operator must possess sufficient experience for the boat operation and trained in the following: ▪ Know the hazards that may be faced during the operation. ▪ Proper use of all equipment. ▪ Recognizes any warning signs of a dangerous or prohibited situation. ▪ Safety requirements for boat launching and exiting from the waterway. ▪ Knowledgeable in how to summon rescue and other emergency services as soon as the operator determines that the boat occupants may need assistance to escape from the waterway hazards.	8
	1c. Inadequate or missing safety or emergency equipment	**10**	1c. Verify that the vessel is inspected and all emergency equipment specified in the marine Safety Equipment procedure, S3AM-333-ATT5.	4
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	Work Over Water	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
2. Boarding vessel	2a. Exposure or drowning from falling into waterway	**15**	3a. Watercraft should remain tied to secure anchoring point during loading and unloading activities. When boarding and exiting, do not attempt to carry other tools or equipment, always maintain on hand on the vessel.	8
	2b. Pinch points between docks and the sides of the boat	6	2b. Be aware of hand position when boarding and exiting vessel	3
On-Site Edits:				
3. Working from watercraft – Environmental Concerns	3a. Exposure or drowning from falling into waterway	**10**	3a. Wear proper PPE (e.g., eye protection, leather gloves, long pants, shirt with sleeves, steel-toe shoes, booties, life vest/preserver). Use the buddy system at all times. • At least two individuals or employees are required and both shall be equipped with a life vest and other appropriate PPE dictated by the atmosphere and other hazards. • If one individual must lean outside of the boat confines to perform a task, a lifeline must be attached to the individual. • If the individual falls out of the boat, the lifeline will permit the individual from floating away from the immediate work area and permit a less hazardous rescue. **Note:** If the passenger of the boat should fall into the waterway, the boat operator should never attempt a rescue by leaving the boat. • Unless the boat is anchored, the operator of the boat shall remain at the steering controls at all times.	8
	3b. Inclement weather	**10**	3b. Know what conditions that exist that prevent boating including small craft weather advisory, ice flows or ice packs on waterway, thunderstorms, high wind, excessive boat traffic, etc. **STOP WORK** and exit the water if these conditions exist or can be anticipated.	6
	3c. Hypothermia	**10**	3c. Discuss symptoms of hypothermia before deployment. Have a means of warming (hot liquids, hand warmers, etc., and a set of dry clothing, etc. available on the vessel. Change into dry clothing if you become wet at cold temperatures.	

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Work Over Water**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
Job Steps *List all steps required to perform a task in the sequence they are performed*	**Potential Hazards** *How could you be hurt? What would the injury be?*	**Risk** *(initial)*	**Critical Actions To Mitigate Hazards** *List control measures required to eliminate, control or protect against the potential hazards associated with each job step to minimize the risk of injury or environmental impact.* ***Identify any 'Stop Work' triggers.***	**Risk** *(final)*
			When the water temperature is between 40 and 50 degrees Fahrenheit, field personnel working on the river or canal shall wear a float coat (top half of a Mustang Suit) or a one-piece survival suit. When the water temperature is less than 40 degrees Fahrenheit, field personnel shall wear either a float coat with bib-overalls (a full two-piece Mustang Suit), or a one-piece survival suit.	5
	3d. Heat stress/heat stress	6	3d. Provide adequate drinking water and electrolytes. Have a heat stress control plan (including shelters, work rotation, methods of cooling). Review prevention, symptoms and treatment guidance before deployment.	4
	3e. Sunburn	8	3e. Wear sunscreen and hat, prevent as much solar exposure as possible.	5
On-Site Edits:				
4. Working from watercraft – Physical Hazards	4a. Vessel unstable, vessel collapse, or overweight	**12**	4a. Select correct vessel for the work & do not carry weight in excess of vessel capacity. Allow for fuel and weight of samples, etc., to be brought on board.	4
	4b. Slips/trips/falls on vessel	**10**	4b. Avoid standing up in vessel. If necessary, have one hand holding onto the boat. Keep Practice good housekeeping to keep the ground around the sampling location clear of obstructions, equipment and other tripping hazards. Whenever there exists the possibility of falling into water, personnel must be attired in a USCG approved Type III or Type V work vest. The vest must be properly sized for the individual and must be secured at all times.	4
	4c. Striking submerged underwater hazards or going aground on mud flats or shallow bottoms	8	4c. Be aware of tidal levels and proximity to shallow water. Be aware of underwater debris near site and shoreline.	4
On-Site Edits:				

Task Hazard Analysis

AECOM Imagine it. Delivered.

Task Name:	**Work Over Water**	Error! Reference source not found.

REMINDER: Use 4-Sight at the start of, and continuously throughout the job/task to identify additional and/or hazards to act on!				
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5. Working from watercraft – Biological Hazards	5a. Poisonous plants, ticks, mosquitoes and other insects	6	5a. Assess work area for poisonous plants and communicate observations to avoid them. All field clothing and equipment should be thoroughly cleaned, removed and/or segregated from clean clothing, equipment and supplies to avoid transfer of hazardous plants oils and inspects. If contact with poisonous plants or ticks are unavoidable, use controls including the use of disposable (Tyvek) coveralls, insect repellent (23.8% DEET or similar), light colored clothing, barrier creams, and frequent tick checks. All employees should bath immediately following fieldwork and use soaps/ cleansers designed to remove oils associated with poison oak, and conduct a full body tick check using a mirror.	4
On-Site Edits:				
6.	5a.		5a.	
On-Site Edits:				
7.	6a.		6a.	
On-Site Edits:				

Task Hazard Analysis

Task Name:	Work Over Water	Error! Reference source not found.

Additional Notes:

Task Hazard Analysis

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All Employees:

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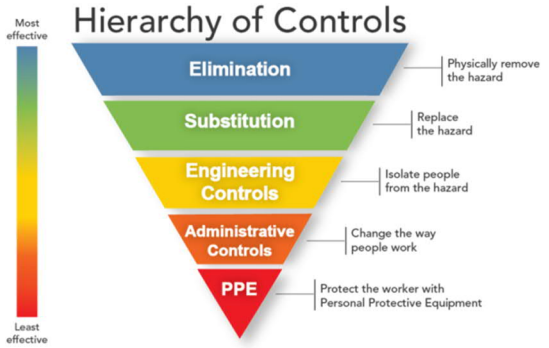

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Task Hazard Analysis

Task Name:	Work Over Water	Error! Reference source not found.

Include a copy of the new THA or a photo of the THA modifications as appropriate.

Attachment D

Site Orientation

Attachment D. Site Orientation

AECOM will conduct a site safety briefing for a person's initial visit to the site. The briefing will be conducted:

- Prior to the start of work;
- For any new AECOM or subconsultant personnel; and
- At each mobilization, or whenever there is a change in task or significant change in task location.

All personnel working on the project who have received the site briefing (including the HASP review) will sign the Personal Acknowledgement located at the end of the HASP. Visitors may receive a shortened version to address the hazards specific to their visit.

The following items, at minimum, will be discussed during the site safety briefing:

- Contents of this HASP;
- The Emergency Response Plan;
- Contractor SH&E Management expectations;
- Injury management, including notification and hospital and occupational clinic locations;
- The AECOM 4-Sight program;
- Stop Work authority;
- The THAs (**Attachment B**) for the tasks that will be performed on a given project;
- Types of hazards at the site and means for minimizing exposure to them;
- Instructions for new operations to be conducted, and safe work practices;
- PPE that must be used;
- Lone worker check-in procedures;
- Emergency evacuation routes, muster points, and tornado/storm shelters; and
- Location and use of emergency equipment.

These meetings must be documented and maintained in the project files.

Attachment E

Safety Data Sheets (SDSs)

CHEM SERVICE INC -- 1,1,1-TRICHLOROETHANE, F11 -- 6810-00N052461

========== Product Identification ==========

Product ID:1,1,1-TRICHLOROETHANE, F11
MSDS Date:07/03/1991
FSC:6810
NIIN:00N052461
MSDS Number: BVMHY
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Info Phone Num:215-692-3026
Emergency Phone Num:215-692-3026
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Phone:215-692-3026
CAGE:84898
Company Name:CHEM SERVICE, INC
Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
ZIP:19301-9650
Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:ETHANE, 1,1,1-TRICHLORO-; (1,1,1-TRICHLOROEHANE) (SARA
III)
CAS:71-55-6
RTECS #:KJ2975000
OSHA PEL:350 PPM
ACGIH TLV:350 PPM/450STEL
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS
Ozone Depleting Chemical:1

Ingred Name:SUPDAT:CAUSE LIVER DMG. EXPOS CAN CAUSE KIDNEY DMG. ALL
CHEM SHOULD BE CONSIDERED HAZ. AVOID DIRECT PHYSICAL CONTACT.
RTECS #:9999999ZZ

Ingred Name:FIRST AID PROC:ASSISTANCE HAS ARRIVED. REMOVE & WASH
CONTAMD CLTHG. IF PATIENT IS EXHIBITING SIGNS OF SHOCK - (ING 4)
RTECS #:9999999ZZ

Ingred Name:ING 3:KEEP WARM & QUIET. IF SWOLLOWED DO NOT INDUCE VOMIT.

CONT POIS CTL CTR IMMED IF NEC. DO NOT ADMIN LIQ/ (SUPDAT)
RTECS #:9999999ZZ

Ingred Name:ING 4:INDUCE VOMIT TO AN UNCON/CONVULSING PERSON. IF PATIENT IS VOMIT-WATCH CLOSELY TO MAKE SURE AIRWAY DOES (ING 6)
RTECS #:9999999ZZ

Ingred Name:ING 5:NOT BECOME OBSTRUCTED BY VOMIT. GET MED ATTN IF NEC. AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT (ING 7)
RTECS #:9999999ZZ

Ingred Name:ING 6:OF A POISON. IT SHOULD BE ADMINISTERED ONLY BY PHYS/TRAINED EMER PERS. MEDICAL ADVICE CAN BE OBTAINED (ING 8)
RTECS #:9999999ZZ

Ingred Name:ING 7:FROM A POISON CONTROL CENTER.
RTECS #:9999999ZZ

Ingred Name:OTHER PRECAUT:THIS PROD IS FURNISHED FOR LABORATORY USE ONLY! PRODUCTS MAY NOT BE USED AS DRUGS, COSMETICS, (ING 10)
RTECS #:9999999ZZ

Ingred Name:ING 9:AGRICULTURAL OR PESTICIDAL PRODUCTS, FOOD ADDITIVES OR AS HOUSEHOLD CHEMICALS.
RTECS #:9999999ZZ

========== Hazards Identification ==========

LD50 LC50 Mixture:LD50:(ORAL, RAT)10300 MG/KG
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:CHLOROCARBON MATLS HAVE PRDCED SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE A SIMILAR EFT IN HUMANS. ADRENOMIMETICS (E.G. EPINEPHRINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAIN ING USES IN HUMANS ACUTELY OR CHRONICALLY EXPOSED TO CHLOROCARBONS . CONT LENSES SHOULD NOT BE (EFTS OF OVEREXP)
Explanation of Carcinogenicity:NOT RELEVANT.
Effects of Overexposure:HLTH HAZ:WORN IN LAB. ALL CHEM SHOULD BE CONSIDERED HAZ. AVOID DIRECT PHYSICAL CONT! CAN CAUSE EYE IRRIT. CAN BE IRRITATING TO MUC MEMB. NARCOTIC @ HIGH CONC. POSS CARCIN. MAY BE HARMFUL IF ABSORBED T HRU SKIN. MAY BE HARMFUL IF INHALED. MAY BE HARMFUL IF SWALLOWED. CAN CAUSE SKIN IRRIT. DUST AND/OR VAP CAN (SUPDAT)
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

========== First Aid Measures ==========

First Aid:INGEST:CALL MD IMMEDIATELY . EYES:FLUSH CONTINUOUSLY W/WATER FOR 15-20 MIN. SKIN:FLUSH W/WATER FOR 15-20 MIN. IF NO BURNS HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL:REMOVE PATIENT TO FRESH AIR. ADMIN OXYG IF PATIENT IS HAVING DFCLTY BRTHG. IF PATIENT HAS STOPPED BRTHG ADMIN ARTF RESP. IF PATIENT IS IN CARDIAC ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED (ING 3)

========== Fire Fighting Measures ==========

Flash Point:NON-FLAMMABLE
Lower Limits:7.0%
Upper Limits:16.0%

Extinguishing Media:CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA & FULL PROTECTIVE EQUIPMENT .
Unusual Fire/Explosion Hazard:THERMAL DECOMP PRODS MAY CONTAIN HCL AND PHOSGENE .

========== Accidental Release Measures ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPROP OSHA REGULATED EQUIP. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATL. SWEEP UP & PLACE IN APPROP CNTNR. HOLD FOR DISP. WASH CONTAMD SURF TO REMOVE ANY RESIDUES.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

========== Handling and Storage ==========

Handling and Storage Precautions:THIS CHEM SHOULD BE HNDLD ONLY IN HOOD. EYE SHIELDS SHOULD BE WORN. USE APPROP OSHA/MSHA APPRVD SFTY EQUIP. STORE ONLY WITH COMPATIBLE CHEMICALS.
Other Precautions:AVOID CONT W/SKIN, EYES & CLTHG. KEEP TIGHTLY CLSD IN COOL DRY PLACE. NO SMOKING IN AREA OF USE. DO NOT USE IN GEN VICINITY OF ARC WELDING, OPEN FLAMES/HOT SURF. HEAT &/OR UV RADIA MAY CAUSE FORMATION OF HCL &/OR PHOSGENE . (ING 9)

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN .
Ventilation:THIS CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves:IMPERVIOUS GLOVES .
Eye Protection:ANSI APPRVD CHEM WORK GOGG .
Other Protective Equipment:NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health
SOL IN H*20:VERY SLIGHTLY SOLUBLE. MATLS TO AVOID:(E.G. SODIUM). INCOMPATIBLE W/POWDERED METALS, NITRATES AND W/CAUSTICS. EFTS OF OVEREXP:CAUSE IRRIT TO RESP TRACT. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HANDLING OF CMPD BECAUSE IT WILL INCREASE TOX OF CMPD. CAN CAUSE AN ALLERGIC SKIN REACTION. EXPOS CAN (ING 2)

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:165F,74C
Melt/Freeze Pt:M.P/F.P Text:90.5F,32.5C
Vapor Pres:100 @20C
Spec Gravity:1.3376
Evaporation Rate & Reference:NOT KNOWN
Solubility in Water:SUPP DATA
Appearance and Odor:COLORLESS LIQUID, FRUITY/PLEASANT ODOR

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZING AGENTS. INCOMPATIBLE W/IRON & ZINC & OTHER LIGHT METALS. INCOMPATIBLE W/ACTIVE METALS (SUPDAT)
Stability Condition to Avoid:DO NOT USE MAGNESIUM/ALUMINUM OR THEIR ALLOYS AS CNTNRS. REACTS VIOLENTLY W/KETONES & WIDE VARIETY OF OTHER CMPDS.
Hazardous Decomposition Products:HCL & PHOSGENE . DECOMPOSITION LIBERATES TOXIC FUMES.

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN CHEM INCIN EQUIPPED W/AN AFTERBURNER & SCRUBBER. DISPOSAL MUST BE I/A/W FEDERAL, STATE & LOCAL REGULATIONS .

CHEM SERVICE INC -- F13 1,1-DICHLOROETHANE -- 6550-00F037545

========== Product Identification ==========

Product ID:F13 1,1-DICHLOROETHANE
MSDS Date:06/01/1989
FSC:6550
NIIN:00F037545
MSDS Number: BWJHT
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Address:660 TOWER LN
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381-3108
Country:US
Info Phone Num:215-692-3026/800-452-9994
Emergency Phone Num:215-692-3026/800-452-9994
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
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Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
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Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:1,1-DICHLOROETHANE (ETHYLIDINE CHLORIDE)
CAS:75-34-3
RTECS #:KI0175000
Other REC Limits:200 PPM
OSHA PEL:100 PPM
ACGIH TLV:200 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

========== Hazards Identification ==========

LD50 LC50 Mixture:ORAL LD50 (RAT/MOUSE): 725 MG/KG
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SKIN: RAPIDLY
ABSORBED/HARMFUL/IRRITATION/ALLERGIC REACTION/SENSITIZATION.
INHALATION: HARMFUL/RESPIRATORY TRACT IRRITATION/MUCOUS MEMBRANE
IRRITATION. INGESTION: HARMFUL. EYES: IRRITATION. EXPOSURE C AN

CAUSE LIVER/KIDNEY/NERVOUS SYSTEM INJURY, DELAYED ADVERSE HEALTH AFFECTS. NARCOTIC AT HIGH CONCENTRATIONS.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:IRRITATION, DISORIENTATION.

========== First Aid Measures ==========

First Aid:EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WARM & QUIET. INGESTION: DO N'T INDUCE VOMITING/GIVE LIQUIDS IF UNCONSCIOUS/CONVULSIVE. IF VOMITING, WATCH CLOSELY FOR ANY AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

========== Fire Fighting Measures ==========

Flash Point:23F
Lower Limits:6
Upper Limits:16
Extinguishing Media:CO2, DRY CHEMICAL POWDER. DON'T USE WATER.
Unusual Fire/Explosion Hazard:FLAMMABLE CHEMICAL.

========== Accidental Release Measures ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.

========== Handling and Storage ==========

Handling and Storage Precautions:KEEP TIGHTLY CLOSED IN A COOL DRY PLACE. STORE ONLY W/COMPATIBLE CHEMICALS. FOR LABORATORY USE ONLY.
Other Precautions:AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection:EYE SHIELDS
Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING &/SHOES.
Supplemental Safety and Health

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:135.14F
Melt/Freeze Pt:M.P/F.P Text:-142.6F
Vapor Pres:182
Vapor Density:3.4
Solubility in Water:SLIGHT
Appearance and Odor:COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES

STRONG OXIDIZING AGENTS/BASES, CAUSTICS.
Stability Condition to Avoid:SENSITIVE TO HEAT.
Hazardous Decomposition Products:TOXIC FUMES.

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

CHEM SERVICE INC -- 1,2-DICHLOROETHANE, F10 -- 6810-00N081237

========== Product Identification ==========

Product ID:1,2-DICHLOROETHANE, F10
MSDS Date:01/02/1996
FSC:6810
NIIN:00N081237
MSDS Number: CFZWW
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Info Phone Num:610-692-3026
Emergency Phone Num:610-692-3026
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Phone:215-692-3026
CAGE:84898
Company Name:CHEM SERVICE, INC
Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
ZIP:19301-9650
Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:ETHANE, 1,2-DICHLORO-; (1,2-DICHLOROETHANE) (SARA 313)
(CERCLA)
CAS:107-06-2
RTECS #:KI0525000
OSHA PEL:50 PPM
ACGIH TLV:10 PPM
EPA Rpt Qty:100 LBS
DOT Rpt Qty:100 LBS

Ingred Name:FIRST AID PROC: IF BRTHG HAS STOPPED, ADMIN ARTF RESP. IF
PATIENT IS IN CARD ARREST ADMIN CPR. CONTINUE LIFE (ING 3)
RTECS #:9999999ZZ

Ingred Name:ING 2: SUPPORTING MEASURES UNTIL MED ASSIST HAS ARRIVED.
REMOVE & WASH CONTAM CLTHG. IF PATIENT IS EXHIBITING (ING 4)
RTECS #:9999999ZZ

Ingred Name:ING 3: SIGNS OF SHOCK, KEEP WARM & QUIET. INGEST: DO NOT
INDUCE VOMIT. CONT POIS CTL CTR IMMED IF NEC. DO NOT (ING 5)

RTECS #:9999999ZZ

Ingred Name:ING 4: ADMIN LIQS/INDUCE VOMIT TO AN UNCON/CONVULSING PERS. IF PATIENT IS VOMIT WATCH CLOSELY TO MAKE SURE (ING 6)
RTECS #:9999999ZZ

Ingred Name:ING 5: AIRWAY DOES NOT BECOME OBSTRUCTED BY VOMIT. GET MEDICAL ATTENTION IF NECESSARY.
RTECS #:9999999ZZ

Ingred Name:OTHER PREC: PROD MAY NOT BE USED AS DRUGS, COSMETICS, AGRICULTURAL/PESTICIDAL PRODS, FOOD ADDITIVES/AS HOUSEHOLD CHEMS.
RTECS #:9999999ZZ

========== Hazards Identification ==========

LD50 LC50 Mixture:LD50 (ORAL RAT): 670 MG/KG.
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO
Health Hazards Acute and Chronic:ACUTE: CAN CAUSE EYE & SKIN IRRIT. MAY BE HARMFUL IF ABSORBED THRU SKIN, INHALED/SWALLOWED. VAPS CAN CAUSE SEV EYE INFLAMM & SWELL OF ADJOINING TISS. CAN CAUSE SEV SKIN BURNS. RPTD EXPOS TO VAPS &/OR DUST CAN CAUSE EYE INJURY. MAY BE RAPIDLY ABSORBED THRU SKIN W/POTENTIAL ADVERSE HLTH EFTS. CAN CAUSE (EFTS OF OVEREXP)
Explanation of Carcinogenicity:ETHYLENE DICHLORIDE: IARC MONO, SUPP, VOL 7, PG 56, 1987: GROUP 2B. NTP 7TH ANNUAL RPT ON CARCINS, 1994: (SUP DAT)
Effects of Overexposure:HLTH HAZ: ALLERGIC RESP RXN. DUST &/OR VAPS CAN CAUSE IRRIT TO RESP TRACT. CAN BE IRRIT TO MUC MEMB. CAN CAUSE NERV SYS INJURY. EXPOS CAN CAUSE LIVER & KIDNEY DMG. CAN CAUSE GI DISTURB. CAN CAUSE ALLE RGIC SKIN RXN. PRLNG EXPOS MAY CAUSE NAUS/HDCH//DIZZ &/OR EYE DMG. CAN CAUSE DELAYED ADVERSE HLTH EFTS. (SUP DAT)
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

========== First Aid Measures ==========

First Aid:AN ANTIDOTE IS A SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT SHOULD BE ADMIN ONLY BY MD/TRAINED EMER PERS. MED ADVICE CAN BE OBTAINED FROM POIS CTL CTR. EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MIN. SKIN: FLUSH W/WATER FOR 15-20 MIN. IF NO BURNS HAVE OCCURRED, USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE TO FRESH AIR. ADMIN OXYGEN IF BRTHG IS DFCLT. (ING 2)

========== Fire Fighting Measures ==========

Flash Point:55.4F,13.0C
Lower Limits:6.2%
Upper Limits:16%
Extinguishing Media:CARBON DIOXIDE OR DRY CHEMICAL POWDER. DO NOT USE WATER.
Fire Fighting Procedures:WEAR NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT .
Unusual Fire/Explosion Hazard:NONE SPECIFIED BY MANUFACTURER.

========== Accidental Release Measures ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL.

SWEEP UP & PLACE IN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

========== Handling and Storage ==========

Handling and Storage Precautions:CONT LENSES SHOULD NOT BE WORN IN LAB. ALL CHEMS SHOULD BE CONSIDERED HAZ. AVOID DIRECT PHYSICAL CONT! AVOID CONT W/SKIN, EYES & CLOTHING.
Other Precautions:DO NOT BREATHE VAPS. KEEP TIGHTLY CLSD. STORE IN COOL DRY PLACE, ONLY W/COMPATIBLE CHEMICALS. PERS NOT SPECIFICALLY & PROPERLY TRAINED SHOULD NOT HANDLE THIS CHEM/ITS CONTR. THIS PROD IS FURNISHED FOR LAB USE ONLY! (ING 7)

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:USE NIOSH APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN .
Ventilation:THIS CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Protective Gloves:IMPERVIOUS GLOVES .
Eye Protection:ANSI APPRVD CHEM WORKERS GOGGLES .
Other Protective Equipment:ANSI APPROVED EMERGENCY EYEWASH & DELUGE SHOWER . USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health
MATLS TO AVOID: ALUMINUM/OR THEIR ALLOYS AS CONTRS. EFTS OF OVEREXP: MAY BE FATAL IF INHALED, SWALLOWED/ABSORBED THRU SKIN. CAN CAUSE SENSIT BY SKIN CONT. EXTREMELY DESTRUCTIVE OF MUC MEMB &/OR UPPER RESP TRACT. PRLNG EXPOS CAN CAUSE SEV SKIN IRRIT. EXPLAN OF CARCIN: ANTIC TO BE CARCIN. ANIMAL: GI.

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:>181F,>83C
Melt/Freeze Pt:M.P/F.P Text:-31F,-35C
Vapor Pres:64 @ 20C
Solubility in Water:VERY SLIGHTLY SOL
Appearance and Odor:COLORLESS LIQUID; FRUITY/PLEASANT ODOR

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
NITRATES, CAUSTICS, STRONG OXIDIZING AGENTS, ACTIVE METALS (SODIUM), POWDERED METALS. DO NOT USE MAGNESIUM/ (SUP DAT)
Stability Condition to Avoid:SENSITIVE TO HEAT.
Hazardous Decomposition Products:DECOMPOSITION LIBERATES TOXIC FUMES. FLAMMABLE.

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL REGULATIONS .

assume responsibility for the suitability of this information to their particular situation.

CHEM SERVICE INC -- F30 TRANS-1,2-DICHLOROETHENE -- 6550-00F037529

========== Product Identification ==========

Product ID:F30 TRANS-1,2-DICHLOROETHENE
MSDS Date:04/28/1992
FSC:6550
NIIN:00F037529
MSDS Number: BWJGZ
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Address:660 TOWER LN
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381-3108
Country:US
Info Phone Num:215-692-3026/800-452-9994
Emergency Phone Num:215-692-3026/800-452-9994
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Phone:215-692-3026
CAGE:84898
Company Name:CHEM SERVICE, INC
Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
ZIP:19301-9650
Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:TRANS-1,2-DICHLOROETHYLENE, TRANS-1,2-DICHLOROETHENE
CAS:156-60-5
RTECS #:KV9400000
OSHA PEL:200 PPM
ACGIH TLV:200 PPM
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

========== Hazards Identification ==========

LD50 LC50 Mixture:ORAL LD50 (RAT/MOUSE): 7536 MG/KG
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:INHALATION: HARMFUL/RESPIRATORY TRACT
IRRITATION/MUCOUS MEMBRANE IRRITATION. INGESTION: HARMFUL. EYES:
IRRITATION. SKIN: HARMFUL IF ABSORBED/IRRITATION. EXPOSURE CAN
CAUSE CNS DEPRESSION.
Explanation of Carcinogenicity:NONE

Effects of Overexposure:IRRITATION.

========== First Aid Measures ==========

First Aid:EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-2O MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP WAR M & QUIET. INGESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS/CONVULSIVE. IF VOMITING OCCURS, WATCH CLOSELY TO AVOID AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

========== Fire Fighting Measures ==========

Flash Point:39.2F
Lower Limits:9.7
Upper Limits:12.8
Extinguishing Media:CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire/Explosion Hazard:FLAMMABLE CHEMICAL.

========== Accidental Release Measures ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.

========== Handling and Storage ==========

Handling and Storage Precautions:STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION. FOR LABORATORY USE ONLY.
Other Precautions:AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection:EYE SHIELDS
Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING & SHOES.
Supplemental Safety and Health

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:118.4F
Melt/Freeze Pt:M.P/F.P Text:-58F
Solubility in Water:SLIGHT
Appearance and Odor:COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZING AGENTS.
Stability Condition to Avoid:AIR, HEAT, MOISTURE, LIGHT.
Hazardous Decomposition Products:TOXIC FUMES/CO/CO2/HYDROGEN CHLORIDE

GAS. DECOMPOSITION PRODUCTS ARE CORROSIVE.

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

International Chemical Safety Cards

MONOCHLOROETHANE

ICSC: 0132

MONOCHLOROETHANE
Ethyl chloride
1-Chloroethane
(cylinder)
CH_3CH_2Cl
Molecular mass: 64.5

CAS # 75-00-3
RTECS # KH7525000
ICSC # 0132
UN # 1037
EC # 602-009-00-0

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding) if in liquid state. Use reduced-sparking handtools.	In case of fire: keep cylinder cool by spraying with water.
EXPOSURE		STRICT HYGIENE!	
• **INHALATION**	Abdominal cramps. Dizziness. Dullness. Headache.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	MAY BE ABSORBED! ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves. Protective clothing.	Remove contaminated clothes. ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
• **EYES**	Redness. Pain. Blurred vision.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**	Abdominal cramps. Headache. Sore throat (further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING

Evacuate danger area! Consult an expert! Ventilation (extra personal protection: self-contained breathing apparatus).	Fireproof. Separated from (see Chemical Dangers).	Special insulated cylinder. Special fittings. F symbol R: 13 S: 9-16-33 UN Haz Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0132

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

MONOCHLOROETHANE

ICSC: 0132

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED LIQUEFIED GAS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is heavier than air and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS:
The substance decomposes on heating or on burning producing toxic gases (hydrogen chloride - see ICSC # 0163, phosgene - see ICSC # 0007). Reacts violently with oxidants, alkaline metals, calcium, magnesium, aluminum powder, and zinc. Reacts with water or steam producing corrosive fumes of hydrogen chloride.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV (as TWA): 1000 ppm; 2640 mg/m^3 (ACGIH 1992-1993).
MAK: 1000 ppm; 2600 mg/m^3; (1992).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and through the skin, and by ingestion.

INHALATION RISK:
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes, the skin and the respiratory tract. Inhalation of vapour may cause narcotic effects. Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the nervous system, liver, and kidneys.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES

Boiling point: 12.5°C
Melting point: -142°C
Relative density (water = 1): 0.918
Solubility in water, g/100 ml at 20°C: 0.574
Vapour pressure, kPa at 20°C: 133.3
Relative vapour density (air = 1): 2.22
Flash point: -50°C (c.c.)
Auto-ignition temperature: 510°C
Explosive limits, vol% in air: 3.6-14.8
Octanol/water partition coefficient as log Pow: 1.54

ENVIRONMENTAL DATA

This substance may be hazardous to the environment; special attention should be given to water and air.

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is indicated. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Rinse contaminated clothes (fire hazard) with plenty of water. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.

Transport Emergency Card: TEC (R)-616

NFPA Code: H 2; F 4; R 0;

ADDITIONAL INFORMATION

ICSC: 0132 **MONOCHLOROETHANE**

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

MSDS Material Safety Data Sheet

From: Avantor Performance Materials, Inc.
Saucon Valley Plaza
3477 Corporate Parkway
Suite #200
Center Valley, PA 18034

MACRON FINE CHEMICALS™ J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service, 1-855-AVANTOR (855-282-6867) for assistance.

TETRACHLOROETHYLENE

1. Product Identification

Synonyms: ethylene tetrachloride; tetrachloroethene; perchloroethylene; carbon bichloride; carbon dichloride
CAS No.: 127-18-4
Molecular Weight: 165.83
Chemical Formula: Cl2C:CCl2
Product Codes:
J.T. Baker: 9218, 9360, 9453, 9465, 9469
Macron: 1933, 8058

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Tetrachloroethylene	127-18-4	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 2 - Moderate (Life)
Lab Protective Equip: GOGGLES; LAB COAT; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Irritating to the upper respiratory tract. Giddiness, headache, intoxication, nausea and vomiting may follow the inhalation of large amounts while massive amounts can cause breathing arrest, liver and kidney damage, and death. Concentrations of 600 ppm and more can affect the central nervous system after a few minutes.
Ingestion:
Not highly toxic by this route because of low water solubility. Used as an oral dosage for hookworm (1 to 4 ml). Causes abdominal pain, nausea, diarrhea, headache, and dizziness.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. May be absorbed through the skin with possible systemic effects.
Eye Contact:
Causes irritation, redness, and pain.
Chronic Exposure:
May cause liver, kidney or central nervous system damage after repeated or prolonged exposures. Suspected cancer risk from animal studies.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired liver or kidney function may be more susceptible to the effects of the substance. The use of alcoholic beverages enhances the toxic effects.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion:
Aspiration hazard. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard but becomes hazardous in a fire situation because of vapor generation and possible degradation to phosgene (highly toxic) and hydrogen chloride (corrosive). Vapors are heavier than air and collect in low-lying areas.
Explosion:
Not considered to be an explosion hazard. Containers may explode when involved in a fire.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Store in a cool, dry, ventilated area away from sources of heat or ignition. Isolate from flammable materials. Protect from direct sunlight. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (ceiling),
300 ppm/5min/3-hour (max)

-ACGIH Threshold Limit Value (TLV):
25 ppm (TWA), 100 ppm (STEL); listed as A3, animal carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Ethereal odor.

Solubility:
0.015 g in 100 g of water.
Specific Gravity:
1.62 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
121C (250F)
Melting Point:
-19C (-2F)
Vapor Density (Air=1):
5.7
Vapor Pressure (mm Hg):
18 @ 25C (77F)
Evaporation Rate (BuAc=1):
0.33 (trichloroethylene = 1)

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Slowly decomposed by light. Deteriorates rapidly in warm, moist climates.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition. Hydrogen chloride gas and phosgene gas may be formed upon heating. Decomposes with moisture to yield trichloroacetic acid and hydrochloric acid.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong acids, strong oxidizers, strong alkalis, especially NaOH, KOH; finely divided metals, especially zinc, barium, lithium. Slowly corrodes aluminum, iron and zinc.
Conditions to Avoid:
Moisture, light, heat and incompatibles.

11. Toxicological Information

Oral rat LD50: 2629 mg/kg; inhalation rat LC50: 4100 ppm/6H; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Tetrachloroethylene (127-18-4)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to quickly evaporate. When released into the soil, this material may leach into groundwater. When released into the soil, this material may biodegrade to a moderate

extent. When released to water, this material is expected to quickly evaporate. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals.

Environmental Toxicity:

The LC50/96-hour values for fish are between 1 and 10 mg/l. The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 4L

International (Water, I.M.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 4L

International (Air, I.C.A.O.)

Proper Shipping Name: TETRACHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1897
Packing Group: III
Information reported for product/size: 4L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Tetrachloroethylene (127-18-4)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Tetrachloroethylene (127-18-4)	Yes	Yes	No	Yes

```
--------\Federal, State & International Regulations - Part 1\----------------
                                          -SARA 302-    ------SARA 313------
Ingredient                                RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Tetrachloroethylene (127-18-4)            No    No      Yes        No

--------\Federal, State & International Regulations - Part 2\----------------
                                                        -RCRA-    -TSCA-
Ingredient                                CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Tetrachloroethylene (127-18-4)            100        U210       No


Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Liquid)
```

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2[Z]
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.

Disclaimer:

****

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****

Prepared by: Environmental Health & Safety

Material Safety Data Sheet
Trichloroethylene

ACC# 23850

Section 1 - Chemical Product and Company Identification

MSDS Name: Trichloroethylene
Catalog Numbers: AC158310000, AC158310025, AC421520000, AC421520040, AC421520200, AC421525000, 15831-0010, S80327ACS-1, S80327ACS-2, T340-4, T341-20, T341-4, T341-500, T341J4, T403-4
Synonyms: Ethylene trichloride; 1,1,2-Trichloroethylene; TCE.
Company Identification:

Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410

For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
79-01-6	Trichloroethylene	99+	201-167-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: APHA: 15 max liquid.
Warning! Harmful to aquatic organisms; may cause long-term adverse effects in the aquatic environment. Breathing vapors may cause drowsiness and dizziness. Possible risks of irreversible effects. Cancer hazard. Causes eye and skin irritation. May cause respiratory tract irritation. May cause liver and kidney damage. May cause central nervous system effects.
Target Organs: Kidneys, central nervous system, liver, spleen, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes eye irritation. Contact with trichloroethylene causes pain but no permanent injury to the eyes. (Doc of TLV)
Skin: Causes skin irritation. May be harmful if absorbed through the skin.
Ingestion: May cause irritation of the digestive tract. May be harmful if swallowed. May cause central nervous system effects.
Inhalation: May cause respiratory tract irritation. May cause liver and kidney damage. May be harmful if inhaled. May cause central nervous system effects. The chief symptoms of TCE exposure were found to be abnormal fatigue, irritability, headache, gastric disturbances, and intolerance to alcohol. (Doc to TLV)
Chronic: Prolonged or repeated skin contact may cause defatting and dermatitis. May cause liver and kidney damage. May cause cancer in humans. Repeated exposure may cause damage to the

spleen. Adverse reproductive effects have been reported in animals. Laboratory experiments have resulted in mutagenic effects. Possible risk of irreversible effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Ingestion: Do not induce vomiting. Get medical aid.
Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.
Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.
Flash Point: Not applicable.
Autoignition Temperature: 410 deg C (770.00 deg F)
Explosion Limits, Lower:7.9 Vol %
Upper: 90 Vol %
NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 1

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Use a spark-proof tool. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Do not get in eyes, on skin, or on clothing. Keep away from heat, sparks and flame. Do not ingest or inhale. Use only in a chemical fume hood.
Storage: Keep away from sources of ignition. Store in a cool, dry place. Store in a tightly closed container. Store protected from light.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an

eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Trichloroethylene	10 ppm TWA; 25 ppm STEL	1000 ppm IDLH	100 ppm TWA; 200 ppm Ceiling

OSHA Vacated PELs: Trichloroethylene: 50 ppm TWA; 270 mg/m3 TWA

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless - APHA: 15 max

Odor: chloroform-like

pH: Not available.

Vapor Pressure: 77.3 mbar @ 20 deg C

Vapor Density: 4.5 (air=1)

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 87 deg C @ 760 mmHg

Freezing/Melting Point:-86 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble.

Specific Gravity/Density:1.460

Molecular Formula:C2HCl3

Molecular Weight:131.39

Section 10 - Stability and Reactivity

Chemical Stability: Moisture sensitive. Light sensitive.

Conditions to Avoid: Incompatible materials, light, ignition sources, excess heat, exposure to moist air or water.

Incompatibilities with Other Materials: Strong oxidizing agents, strong reducing agents, bases, active metals, metals and metal compounds (toxic, e.g. beryllium, lead acetate, nickel carbonyl, tetraethyl lead).

Hazardous Decomposition Products: Hydrogen chloride, carbon monoxide, carbon dioxide.

Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 79-01-6: KX4550000
LD50/LC50:
CAS# 79-01-6:
Draize test, rabbit, eye: 20 mg/24H Moderate;
Draize test, rabbit, skin: 2 mg/24H Severe;
Inhalation, mouse: LC50 = 8450 ppm/4H;
Inhalation, mouse: LC50 = 220000 mg/m3/20M;
Inhalation, mouse: LC50 = 262000 mg/m3/30M;
Inhalation, mouse: LC50 = 40000 mg/m3/4H;
Inhalation, rat: LC50 = 140700 mg/m3/1H;
Oral, mouse: LD50 = 2402 mg/kg;
Oral, mouse: LD50 = 2400 mg/kg;
Oral, rat: LD50 = 4920 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
Skin, rabbit: LD50 = 20 mL/kg;
.

Carcinogenicity:
CAS# 79-01-6:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 4/1/88
- **NTP:** Suspect carcinogen
- **IARC:** Group 2A carcinogen

Epidemiology: Tumorigenic effects have been reported in experimental animals.
Teratogenicity: Teratogenic effects have occurred in experimental animals.
Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.
Mutagenicity: Mutagenic effects have occurred in humans.
Neurotoxicity: No information available.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 41-67 mg/L; 96 hrs.; LC50Daphnia: Daphnia: 2.2-100 mg/L; 48 hrs.; LC50Mollusk Shrimp: 2 mg/L; 96 hrs.; LC50 Bluegill sunfish, LD50= 44,700 ug/L/96Hr. Fathead minnow, LC50=40.7 mg/L/96Hr.
Environmental: In air, substance is photooxidized and is reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water, it evaporates rapidly. Potential for mobility in soil is high.
Physical: No information available.
Other: Bioconcentration potential is low (BCF less than 100).

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.
RCRA U-Series:
CAS# 79-01-6: waste number U228.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	TRICHLOROETHYLENE	TRICHLOROETHYLENE
Hazard Class:	6.1	6.1
UN Number:	UN1710	UN1710
Packing Group:	III	III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 79-01-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 79-01-6: 100 lb final RQ; 45.4 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 79-01-6: immediate, delayed, reactive.
Section 313
This material contains Trichloroethylene (CAS# 79-01-6, 99+%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR
Clean Air Act:
CAS# 79-01-6 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 79-01-6 is listed as a Hazardous Substance under the CWA. CAS# 79-01-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-01-6 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 79-01-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65
The following statement(s) is(are) made in order to comply with the California Safe

Drinking Water Act:
WARNING: This product contains Trichloroethylene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 79-01-6: 50 æg/day NSRL (oral); 80 æg/day NSRL (inhalation)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 36/38 Irritating to eyes and skin.
R 45 May cause cancer.
R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 67 Vapours may cause drowsiness and dizziness.
R 68 Possible risk of irreversible effects.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 79-01-6: 3

Canada - DSL/NDSL

CAS# 79-01-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1B, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 79-01-6 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 2/01/1999
Revision #9 Date: 6/03/2008

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

CHEM SERVICE INC -- 0-659 CIS 1,2-DICHLOROETHENE -- 6550-00F037480

========== Product Identification ==========

Product ID:0-659 CIS 1,2-DICHLOROETHENE
MSDS Date:06/02/1992
FSC:6550
NIIN:00F037480
MSDS Number: BWJDT
=== Responsible Party ===
Company Name:CHEM SERVICE INC
Address:660 TOWER LN
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381-3108
Country:US
Info Phone Num:215-692-3026/800-452-9994
Emergency Phone Num:215-692-3026/800-452-9994
CAGE:84898
=== Contractor Identification ===
Company Name:CHEM SERVICE INC
Box:3108
City:WEST CHESTER
State:PA
ZIP:19381
Country:US
Phone:215-692-3026
CAGE:84898
Company Name:CHEM SERVICE, INC
Address:660 TOWER LN
Box:599
City:WEST CHESTER
State:PA
ZIP:19301-9650
Country:US
Phone:610-692-3026
CAGE:8Y898

========== Composition/Information on Ingredients ==========

Ingred Name:DICHLOROETHENE
CAS:156-59-2
RTECS #:KV9420000

========== Hazards Identification ==========

Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO
Health Hazards Acute and Chronic:SKIN: MAY BE HARMFUL IF ABSORBED. CAN
CAUSE IRRITATION. INHALATION: MAY BE HARMFUL. DUST &/VAPORS CAN
CAUSE RESPIRATORY TRACT IRRITATION. CAN BE IRRITATING TO MUCOUS
MEMBRANCES. INGESTION: MAY BE HARM FUL. EYES: IRRITATION. EXPOSURE
CAN CAUSE LIVER DAMAGE. NARCOTIC AT HIGH CONCENTRATIONS.
Explanation of Carcinogenicity:NONE
Effects of Overexposure:IRRITATION, NARCOTIC.

========== First Aid Measures ==========

First Aid:EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE. INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED & CONTINU E LIFE SUPPORT UNTIL MEDICAL ASSISTANCEARRIVES. INGESTION: RINSE MOUTH OUT W/WATER, IF CONSCIOUS. OBTAIN MEDICAL ATTENTION IN ALL CASES.

========== Fire Fighting Measures ==========

Flash Point:42.8F
Extinguishing Media:CO2, DRY CHEMICAL POWDER/SPRAY.
Unusual Fire/Explosion Hazard:FLAMMABLE CHEMICAL. VAPORS MAY TRAVEL CONSIDERABLE DISTANCE TO IGNITION SOURCE & FLASH BACK. DECOMPOSITION PRODUCTS ARE CORROSIVE.

========== Accidental Release Measures ==========

Spill Release Procedures:EVACUATE AREA. WEAR APPRORPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.

========== Handling and Storage ==========

Handling and Storage Precautions:STORE IN A COOL DRY PLACE ONLY W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER REFRIGERATION.
Other Precautions:AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL CONTACT.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.
Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.
Eye Protection:EYE SHIELDS
Supplemental Safety and Health

========== Physical/Chemical Properties ==========

Boiling Pt:B.P. Text:140F
Melt/Freeze Pt:M.P/F.P Text:-112F
Solubility in Water:INSOLUBLE
Appearance and Odor:COLORLESS LIQUID

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
STRONG OXIDIZING AGENTS, MAGNESIUM, ALUMINUM.
Stability Condition to Avoid:MOISTURE, AIR, LIGHT, HEAT & OTHER IGNITION SOURCES.
Hazardous Decomposition Products:TOXIC FUMES

========== Disposal Considerations ==========

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

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International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

VINYL CHLORIDE
Chloroethene
Chloroethylene
VCM
(cylinder)
$C_2H_3Cl/H_2C=CHCl$
Molecular mass: 62.5

CAS # 75-01-4
RTECS # KU9625000
ICSC # 0082
UN # 1086 (inhibited)
EC # 602-023-00-7

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive. Vinyl chloride monomer vapours are uninhibited and may form polymers in vents or flame arresters of storage tanks, resulting in blockage of vents.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking handtools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		AVOID ALL CONTACT!	
• **INHALATION**	Dizziness. Drowsiness. Headache. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
• **SKIN**	ON CONTACT WITH LIQUID: FROSTBITE.	Protective gloves. Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes.
• **EYES**	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**		Do not eat, drink, or smoke during work. Wash hands before eating.	

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation (extra personal protection: complete protective clothing including self-contained	Fireproof. Separated from incompatible materials (see Chemical Danger). Cool.	F symbol T symbol R: 45-13

breathing apparatus).		S: 53-9-16-44 Note: D UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0082

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

VINYL CHLORIDE

ICSC: 0082

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED LIQUEFIED GAS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is heavier than air, and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS:
The substance can under specific circumstances form peroxides, initiating explosive polymerization. The substance will polymerize readily due to heating and under the influence of air, light, and on contact with a catalyst, strong oxidizing agents and metals such as copper and aluminium, with fire or explosion hazard. The substance decomposes on burning producing toxic and corrosive fumes (hydrogen chloride and phosgene).

OCCUPATIONAL EXPOSURE LIMITS (OELs):
TLV: 5 ppm; 13 mg/m^3 (ACGIH 1993-1994).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
A harmful concentration of this gas in the air will be reached very quickly on loss of containment.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes. The liquid may cause frostbite. The substance may cause effects on the central nervous system. Exposure could cause lowering of consciousness. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the liver, blood vessels and connective tissue. This substance is carcinogenic to humans. May cause heritable genetic damage in humans.

PHYSICAL PROPERTIES

Boiling point: -13°C
Melting point: -154°C
Relative density (water = 1): 0.9
Solubility in water: none
Relative vapour density (air = 1): 2.2

Flash point: -78°C c.c.°C
Auto-ignition temperature: 472°C
Explosive limits, vol% in air: 3.6-33
Octanol/water partition coefficient as log Pow: 0.6

ENVIRONMENTAL DATA

NOTES

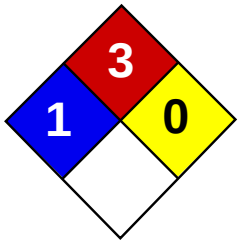
According to ACGIH this substance belongs to Group A1 indicating confirmed human carcinogen. Contains inhibitors (e.g. phenol). Depending on the degree of exposure, periodic medical examination is indicated. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding.

Transport Emergency Card: TEC (R)-150
NFPA Code: H 2; F 4; R 2;

ADDITIONAL INFORMATION

ICSC: 0082 **VINYL CHLORIDE**

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

CI#: Not applicable.

Synonym: 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetone	67-64-1	100

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat]. 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Flash Points: CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:
Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:
Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:
Store in a segregated and approved area (flammables area) . Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Austalia] TWA: 1185 STEL: 2375 (mg/m3) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)

Vapor Density: 2 (Air = 1)

Volatility: Not available.

Odor Threshold: 62 ppm

Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3000 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizzness, drowsiness, confusion, headache, muscle weakeness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting). Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also

affect the Central Nevous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis. Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fatthead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde Connecticut hazardous material survey.: Acetone Illinois toxic substances disclosure to employee act: Acetone Illinois chemical safety act: Acetone New York release reporting list: Acetone Rhode Island RTK hazardous substances: Acetone Pennsylvania RTK: Acetone Florida: Acetone Minnesota: Acetone Massachusetts RTK: Acetone Massachusetts spill list: Acetone New Jersey: Acetone New Jersey spill list: Acetone Louisiana spill reporting: Acetone California List of Hazardous Substances (8 CCR 339): Acetone TSCA 8(b) inventory: Acetone TSCA 4(a) final test rules: Acetone TSCA 8(a) IUR: Acetone

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable. R36- Irritating to eyes. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Material safety data sheet issued by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. LOLI, RTECS, HSDB databases. Other MSDSs

Other Special Considerations: Not available.

Created: 10/10/2005 08:13 PM

Last Updated: 05/21/2013 12:00 PM

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FISHER SCIENTIFIC, CHEMICAL DIV. -- METHYLENE CHLORIDE -- 6810-01-406-8142

========== Product Identification ==========

Product ID:METHYLENE CHLORIDE
MSDS Date:05/23/1995
FSC:6810
NIIN:01-406-8142
MSDS Number: BXPXF
=== Responsible Party ===
Company Name:FISHER SCIENTIFIC, CHEMICAL DIV.
Address:1 REAGENT LANE
City:FAIR LAWN
State:NJ
ZIP:07410
Country:US
Info Phone Num:201-796-7100 OR 201-796-7523
Emergency Phone Num:201-796-7100/800-424-9300(CHEMTREC)
CAGE:1B464
=== Contractor Identification ===
Company Name:FISHER SCIENTIFIC CO
Address:2000 PARK LN
Box:City:PITTSBURGH
State:PA
ZIP:15275
Country:US
Phone:412-490-8586
CAGE:22527
Company Name:FISHER SCIENTIFIC CO. CHEMICAL MFG DIV
Address:1 REAGENT LANE
Box:City:FAIRLAWN
State:NJ
ZIP:07410-2802
Country:US
Phone:201-796-7100
CAGE:1B464

========== Composition/Information on Ingredients ==========

Ingred Name:METHYLENE CHLORIDE (SARA 313) (CERCLA)
CAS:75-09-2
RTECS #:PA8050000
Fraction by Wt: 100%
Other REC Limits:NONE RECOMMENDED
OSHA PEL:500 PPM; Z-2
ACGIH TLV:50 PPM, A2; 9495
EPA Rpt Qty:1000 LBS
DOT Rpt Qty:1000 LBS

========== Hazards Identification ==========

LD50 LC50 Mixture:ORAL LD50 (RAT) IS 1600 MG/KG
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO
Health Hazards Acute and Chronic:ACUTE: MAY CAUSE EYE, SKIN &
RESPIRATORY TRACT IRRITATION. MODERATELY TOXIC BY INHALATION AND
INGESTION. CNS DEPRESSANT, CHEMICAL ASPHYXIANT. MAY CAUSE
POISONING OF THE BLOOD, LIVER, KIDNEYS. CHRONIC : PROLONGED OR
REPEATED EXPOSURE MAY CAUSE DAMAGE TO KIDNEY, LIVER, BLOOD. MAY

CAUSE CANCER.
Explanation of Carcinogenicity:METHYLENE CHLORIDE IS LISTED AS AN ANTICIPATED CARCINOGEN BY NTP AND AS A 2B SUSPECTED CARCINOGEN BY IARC.
Effects of Overexposure:INHALED-IRRITATION,DIZZINESS,NAUSEA,NARCOSIS,TINGLING, NUMBNESS IN EXTREMEITIES,STUPOR,STAGGERING. INGESTED-SLOWED RESPIRATION,SIMILAR SYMPTOMS TO INHALATION (CNS DEPRESSION). EYES-IRRITATION,PAIN. SK IN-IRRITATION,PAIN,PARESTHESIAS,POSSIBLE BURNS, DRY/SCALY SKIN.
Medical Cond Aggravated by Exposure:PERSONS WITH SKIN,LIVER,KIDNEY,CARDIOVASCULAR DISEASE OR ANEMIA.

========== First Aid Measures ==========

First Aid:INHALED-REMOVE FRESH AIR IMMEDIATELY. PERFORM ARTIFICIAL RESPIRATION IF NEEDED. GET IMMEDIATE MEDICAAL ATTENTION. SKIN-REMOVE CONTAMINATED CLOTHES/SHOES. WASH WITH SOAP & WATER. GET MEDICAL ATTENTION. EYES-FLUSH WITH LOTS OF WATER FOR 15 MINUTES, LIFT LIDS. GET MEDICAL ATTENTION. INGESTED-IF CONSCIOUS, REMOVE BY GASTRIC LAVAGE OR EMESIS. GET IMMEDIATE MEDICAL ATTENTION.

========== Fire Fighting Measures ==========

Flash Point:NONE SPECIFIED
Autoignition Temp:Autoignition Temp Text:1033F
Lower Limits:13
Upper Limits:23
Extinguishing Media:DRY CHEMCIAL OR CARBON DIOXIDE. FOR LARGER FIRES USE WATER SPRAY, FOG OR REGULAR FOAM.
Fire Fighting Procedures:WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE GEAR. COOL FIRE EXPOSED CONTAINERS WITH WATER.
Unusual Fire/Explosion Hazard:SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

========== Accidental Release Measures ==========

Spill Release Procedures:ELIMINATE ALL SOURCES OF IGNITION. STOP LEAK IF NO RISK. TAKE UP WITH INERT MATERIAL SUCH AS SAND. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA. KEEP UNECESSARY PEOPLE AWAY. RQ=1000 POUNDS; IF RELEASE MEETS OR EXCEEDS THIS, CALL 800-424-8802& LEPC.
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

========== Handling and Storage ==========

Handling and Storage Precautions:STORE IN A COOL, DRY, WELL VENTILATED PLACE AWAY FROM SOURCES OF IGNITION AND INCOMPATIBLE MATERIALS. STORE IN A TIGHTLY CLOSED CONTAINER.
Other Precautions:STORE UNDER NITROGEN. PROTECT AGAINST PHYSICAL DAMAGE TO CONTAINERS.

========== Exposure Controls/Personal Protection ==========

Respiratory Protection:IF ENGINEERING CONTROLS FAIL OR NON-ROUTINE USE OR AN EMERGENCY OCCURS; WEAR AN MSHA/NIOSH APPROVED RESPIRATOR OR AN AIR-SUPPLIED RESPIRATOR OR SCBA, AS REQUIRED. USE IN ACCORDANCE WITH 29 CFR 1910.13 4 AND MANUFACTURER'S RECOMMENDATIONS.
Ventilation:PROCESS ENCLOSURE RECOMMENDED TO MEET EXPOSURE LIMITS.
Protective Gloves:PVA, VITON, NITRILE.

Eye Protection:SAFETY GLASSES/CHEMICAL SPLASH GOGGLES.
Other Protective Equipment:MUST WEAR APPROPRIATE IMPERVIOUS CLOTHING & EQUIPMENT TO PREVENT PROLONGED OR REPEATED SKIN CONTACT. EYE WASH STATION.
Work Hygienic Practices:WASH HANDS AFTER HANDLING AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
Supplemental Safety and Health
OTHER PROTECTIVE EQUIPMENT CONTINUED: QUICK DRENCH SHOWER.

========== Physical/Chemical Properties ==========

HCC:T4
Boiling Pt:B.P. Text:104F,40C
Melt/Freeze Pt:M.P/F.P Text:-139F,-95C
Vapor Pres:400
Vapor Density:2.9
Spec Gravity:1.3266
Viscosity:0.441 CP @2OC
Evaporation Rate & Reference:27.5 (N-BUTYL ACETATE=1)
Solubility in Water:MODERATE (1.32%)
Appearance and Odor:CLEAR, ODORLESS LIQUID; MILD, CHLOROFORM-LIKE ODOR.
Percent Volatiles by Volume:100

========== Stability and Reactivity Data ==========

Stability Indicator/Materials to Avoid:YES
ALKALI METALS, CAUSTICS, STRONG OXIDIZING AGENTS, PLASTICS/RUBBER/COATINGS, VARIOUS METALS (AL,ZN,K,NA,NI,FE,CU....)....
Stability Condition to Avoid:STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.
Hazardous Decomposition Products:MAY INCLUDES TOXIC AND HAZARDOUS PHOSGENE GAS, TOXIC AND CORROSIVE FUMES OF CHLORINE, OXIDES OF CARBON.
Conditions to Avoid Polymerization:HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDE NORMAL TEMEPRATURES AND PRESSURES.

========== Disposal Considerations ==========

Waste Disposal Methods:DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL ENVIRONMENTAL REGULATIONS. EPA/RCRA WASTE NUMBER U080 APPLIES IF UNUSED/UNCONTAMINATED.

International Chemical Safety Cards

ISOBUTENE

ICSC: 1027

ISOBUTENE
Isobutylene
2-Methylpropene
(cylinder)
$C_4H_8/CH_2=C(CH_3)_2$
Molecular mass: 56.1

CAS # 115-11-7
RTECS # UD0890000
ICSC # 1027
UN # 1055
EC # 601-012-00-4

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Extremely flammable.	NO open flames, NO sparks, and NO smoking. NO contact with oxidizing materials.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out; in other cases extinguish with sand, powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive. Risk of fire and explosion on contact with oxidants, halogens (see Chemical Dangers).	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE			
• **INHALATION**	Dizziness. Drowsiness. Dullness. Nausea. Unconsciousness. Vomiting.	Closed system and ventilation.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
• **SKIN**	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
• **EYES**	Frostbite.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• **INGESTION**			

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove all sources of ignition. Do NOT wash away into sewer. NEVER direct water jet on liquid (extra personal protection: self-	Fireproof. Separated from incompatible substances (see Chemical Dangers). Cool.	F symbol F+ symbol R: 12 S: (2-)9-16-33

contained breathing apparatus).		Note: C UN Hazard Class: 2.1

SEE IMPORTANT INFORMATION ON BACK

ICSC: 1027

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

International Chemical Safety Cards

ISOBUTENE

ICSC: 1027

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS COMPRESSED LIQUEFIED GAS OR COLOURLESS VOLATILE LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The gas is heavier than air and may travel along the ground; distant ignition possible, and may accumulate in low ceiling spaces causing deficiency of oxygen. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
The substance can presumably form explosive peroxides. The substance is able to polymerize with fire or explosion hazard. Reacts violently with oxidants, chlorine, fluorine, nitrogen oxides, hydrogen chloride, hydrogen bromide, causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS (OELs):
MAK not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
On loss of containment this liquid evaporates very quickly causing supersaturation of the air with serious risk of suffocation when in confined areas. A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the central nervous system. Exposure may result in death. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES

Boiling point: -6.9°C
Melting point: -140.3°C
Relative density (water = 1): 0.59
Solubility in water: practically insoluble
Vapour pressure, kPa at 20°C: 1976
Relative vapour density (air = 1): 1.94
Flash point: flammable°C
Auto-ignition temperature: 465°C
Explosive limits, vol% in air: 1.8-9.6%

ENVIRONMENTAL DATA

NOTES

Density of the liquid at boiling point: 0.605 kg/l. High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death. Check oxygen content before entering area. Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.

Transport Emergency Card: TEC (R)-502
NFPA Code: H 1; F 4; R 0;

ADDITIONAL INFORMATION

ICSC: 1027	**ISOBUTENE**

IMPORTANT LEGAL NOTICE:	Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use.

MSDS Number: **A2052** * * * * * *Effective Date:* ***08/24/11*** * * * * * *Supersedes:* ***03/28/11***

MSDS Material Safety Data Sheet

From: Avantor Performance Materials, Inc.
Saucon Valley Plaza
3477 Corporate Parkway
Suite #200
Center Valley, PA 18034

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service, 1-855-AVANTOR (855-282-6867) for assistance.

ALCONOX®

1. Product Identification

Synonyms: Proprietary blend of sodium linear alkylaryl sulfonate, alcohol sulfate, phosphates, and carbonates.
CAS No.: Not applicable.
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: A461

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Alconox® proprietary detergent mixture	N/A	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 1 - Slight
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain.
Chronic Exposure:
No information found.
Aggravation of Pre-existing Conditions:
No information found.

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not expected to be a fire hazard.
Explosion:
No information found.
Fire Extinguishing Media:
Dry chemical, foam, water or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust. When mixed with water, material foams profusely. Small amounts of residue may be flushed to sewer with plenty of water.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Moisture may cause material to cake. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
None established.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
For conditions of use where exposure to dust or mist is apparent and engineering controls are not feasible, a particulate respirator (NIOSH type N95 or better filters) may be worn. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-face positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Use chemical safety goggles. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
White powder interspersed with cream colored flakes.
Odor:
No information found.
Solubility:
Moderate (1-10%)
Specific Gravity:
No information found.
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
No information found.
Melting Point:
No information found.
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
No information found.
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.

Incompatibilities:
No information found.
Conditions to Avoid:
No information found.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Alconox® proprietary detergent mixture	No	No	None

12. Ecological Information

Environmental Fate:
This product is biodegradable.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Alconox® proprietary detergent mixture	Yes	No	No	No

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Alconox® proprietary detergent mixture	No	No	Yes	No

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.

Alconox® proprietary detergent mixture	No	No	No	No

\Federal, State & International Regulations - Part 2\

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Alconox® proprietary detergent mixture	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: No Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **0** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes.
Keep container closed.
Use with adequate ventilation.
Avoid breathing dust.
Wash thoroughly after handling.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.

Disclaimer:

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THE INFORMATION PRESENTED IN THIS MATERIAL SAFETY DATA SHEET (MSDS/SDS) WAS PREPARED BY TECHNICAL PERSONNEL BASED ON DATA THAT THEY BELIEVE IN THEIR GOOD FAITH JUDGMENT IS ACCURATE. HOWEVER, THE INFORMATION PROVIDED HEREIN IS PROVIDED "AS IS," AND AVANTOR PERFORMANCE MATERIALS MAKES AND GIVES NO REPRESENTATIONS OR WARRANTIES WHATSOEVER, AND EXPRESSLY DISCLAIMS ALL WARRANTIES REGARDING SUCH INFORMATION AND THE PRODUCT TO WHICH IT RELATES, WHETHER EXPRESS, IMPLIED, OR STATUTORY, INCLUDING WITHOUT LIMITATION, WARRANTIES OF ACCURACY, COMPLETENESS, MERCHANTABILITY, NON-INFRINGEMENT, PERFORMANCE, SAFETY, SUITABILITY, STABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES ARISING FROM COURSE OF DEALING, COURSE OF PERFORMANCE, OR USAGE OF TRADE.

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****

Prepared by: Environmental Health & Safety

Attachment F

Work and Project Plans, Specifications, and/or Drawing

CONSTRUCTION COMPLETION REPORT
SUB-SLAB DEPRESSURIZATION SYSTEM

COLUMBIA CEMENT COMPANY SITE
159 HANSE AVENUE
FREEPORT, NEW YORK
SITE NO. 130052

Prepared for

Burmah Castrol Holding Company
201 Helios Way
Helios Plaza 6.370A
Houston, TX 77079

October 21, 2020

Prepared by

1255 Broad Street
Suite 201
Clifton, New Jersey 07013

Project No: 60481767

LIST OF ACRONYMS

TABLES

FIGURES

APPENDICES

LIST OF ACRONYMS

AECOM	AECOM USA, Inc.
AWQS	Ambient Water Quality Standards
CAMP	Community Air Monitoring Program
CCR	Construction Completion Report
CFM	cubic feet per minute
DMM	Division of Material Management
EC	engineering control
EE	environmental easement
EMI	electromagnetic induction
FER	Final Engineering Report
FS	Feasibility Study
GPR	ground-penetrating radar
GV	Guidance Value
HASP	health and safety plan
IC	institutional control
in. WC	inches of water column
IR	investigate and reduce
ITW	Illinois Tool Works
µg/l	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
MI	mitigate
MO	monitor
MSL	mean sea level
NFA	no further action
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	operation, maintenance and monitoring
OSHA	Occupational Safety and Health Administration
OU-1	Operable Unit No. 1
OU-2	Operable Unit No. 2
PDI	Pre-Design Investigation
PID	photoionization detector
PVC	poly-vinyl chloride
RAO	remedial action objective
RAWP	Remedial Action Work Plan

RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
ROD	Record of Decision
ROI	radius of influence
SCGs	standards, criteria and guidance
SMP	Site Management Plan
SSDS	sub-slab depressurization system
SSO	site safety officer
SVI	soil vapor intrusion
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
USEPA	U. S. Environmental Protection Agency
VI	vapor intrusion
VOC	volatile organic compound

CONSTRUCTION COMPLETION REPORT
SUB-SLAB DEPRESSURIZATION SYSTEM

COLUMBIA CEMENT COMPANY SITE
159 HANSE AVENUE
FREEPORT, NEW YORK
SITE NO. 130052

Certification

I, Daniel Servetas, certify that I am currently a NYS registered professional engineer, I had primary direct responsibility for the implementation of the subject construction program, and I certify that the Remedial Work Plan (or Remedial Design or Plans and Specifications) was implemented and that all construction activities were completed in substantial conformance with the DER-approved Remedial Work Plan (or Remedial Design or Plans and Specifications).

October 21, 2020

Daniel Servetas, P.E.
New York State Licensed Professional
Engineer No. 079068

October 21, 2020

In accordance with New York State Education Law, it is a violation for any person, unless they are acting under the direction of a licensed professional engineer, to alter this report in any way.

1.1 INTRODUCTION

AECOM USA, Inc. (AECOM) has prepared this Construction Completion Report (CCR) to document the installation and operation of a sub-slab depressurization system (SSDS) at the Columbia Cement Company Site, located in Nassau County, Freeport, New York (hereinafter referred to as the "Site"). The Site location is shown on **Figure 1**. This CCR is a required element of the remedial program for the Site. Burmah-Castrol Holdings, Inc. entered into the New York State Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 130052, which is administered by the New York State Department of Environmental Conservation (NYSDEC) through a Consent Decree dated April 29, 1998.

The Site is identified as 2 parcels: Section 62, Block 230, Lot 65 and Section 62, Block 230, Lot 85 on the Nassau County Tax Map. The boundaries of the Site are more fully described in the metes and bounds site descriptions that are part of the Environmental Easement (EE) implemented for the Site. An EE was implemented for both parcels and recorded with Nassau County on June 11, 2020. The boundaries of the site are fully described in **Appendix A** which shows the property description and the survey map.

The remedial action work was performed at the site in accordance with multiple NYSDEC approved Remedial Action Work Plans (RAWPs) for soil and groundwater, as well as the Sub-Slab Depressurization System Design. This CCR will cover the sub-slab vapor mitigation actions conducted under the SSDS Design.

1.2 SITE LOCATION AND DESCRIPTION

The former Columbia Cement facility consists of approximately 2 acres in an area of Freeport, New York that is highly developed with commercial and industrial facilities. Freeport is located in Nassau County on the south shore of Long Island. The site location is shown on Figure 1. The Site building covers approximately 65,000 square feet, and consists of former offices, material storage, production rooms, and warehousing. Ten 8,000-gallon underground storage tanks (USTs) were located near the southeast corner of the property. The Site is bordered by a recycling facility to the north. BA 272, LLC borders the property to the east. Apollo Fine Spirits is located to the south of the property. The property is bordered by Hanse Avenue to the West. Farber Plastics and Love & Quiches bakery are located on the opposite (west) side of Hanse Avenue. A Site Plan is presented as **Figure 2**.

The Site is located on a peninsula on the south side of Long Island. Freeport Creek is located 500 feet west of the Site, and Stadium Park Canal is 1,000 feet east of the site. Stadium Park Canal merges with Freeport Creek approximately 1,500 feet southeast of the site. From this

point, surface water flows south through tidal marshes to the Atlantic Ocean, approximately 5 miles south of the Site. The Site is very flat, ranging from 5 to 8 feet above Mean Sea Level (MSL). Surface water at the site drains to the west toward Freeport Creek. Storm drains located on site, also drain to Freeport Creek.

1.3 SITE HISTORY

The former Columbia Cement Company, which was owned by Burmah Castrol, produced adhesives for a variety of applications. In 1988, while Columbia Cement operated the facility, approximately 1,760 gallons of 1,1,1-trichloroethane (1,1,1-TCA) was released to an unlined storm drain during filling of a storage tank due to a failure of a contractor's tanker truck. The spill was reported, and response measures were performed under regulatory oversight. In 1996, the property was sold to Illinois Tool Works (ITW). TACC, an ITW subsidiary operated the facility from 1996 to 2004 and manufactured adhesives also. In 1998, Burmah Castrol entered into a Consent Agreement (Index WI #W2-02-0813-98-05) with the NYSDEC regarding the 1,1,1-TCA spill. In 2001, BP purchased all Burmah Castrol holdings and assumed responsibility for the 1,1,1-TCA spill.

1.4 SUMMARY OF PREVIOUS INVESTIGATIONS

Numerous phases of a Remedial Investigation were conducted by Delaware Engineering (1997 through 2003) and URS (2003 through 2006). In December 2006, URS submitted a Supplemental Remedial Investigation Report, summarizing all data obtained up to that time. In January 2007, URS submitted a Feasibility Study (FS) Report that evaluated remedial alternatives to address subsurface impacts. In its March 8, 2007 letter, NYSDEC requested installation of monitoring wells adjacent to Freeport Creek to assess the extent of the plume.

In September 2007, BP installed two monitoring wells (MW-07-16S and MW-07-17D) downgradient from the Site and adjacent to Freeport Creek. Sampling results indicated that chloroethane was present in well MW-07-16S at a concentration exceeding the NYSDEC Ambient Groundwater Quality Standard. NYSDEC divided the site into two Operable Units. Operable Unit No. 1 (OU-1) consists of the on-site project area owned by ITW, located at 159 Hanse Avenue, which is approximately 2 acres in size. OU-2 consists of the offsite areas immediately surrounding OU-1. NYSDEC issued a Record of Decision (ROD) for OU1 on March 28, 2008 (NYSDEC, 2008), to select remedies for the Site. In October 2008, BP presented a Remedial Investigation Work Plan (RIWP) for OU-2 to NYSDEC. The RIWP presented a scope of work to evaluate subsurface impacts to OU-2 resulting from the 1988 1,1,1-TCA spill in OU-1.

A Remedial Investigation (RI) was conducted at OU-2 in 2008 and 2009. A Draft RI/FS was submitted to NYSDEC on December 23, 2009. Pilot testing and remedial action were conducted at OU-1 from 2009 through 2012, documented in separate reports. Following the positive results of these actions, NYSDEC requested BP to revise the OU-2 Remedial Investigation Report to incorporate newly acquired data and to revise the FS to take into consideration the effectiveness of the remedy at OU-1. The *Revised Remedial Investigation Report, Operable Unit No. 2 (OU-2) Off-Site Areas, Former Columbia Cement Company, Inc. Facility, 159 Hanse Avenue, Freeport, New York* (RIR) was submitted to NYSDEC on September 18, 2012. On February 18, 2015, a Supplemental Remedial Investigation Report for OU-2 was submitted to NYSDEC summarizing the results of groundwater sampling conducted in 2013 and 2014 in OU-2. The NYSDEC issued a ROD for OU2 on March 16, 2017.

2.1 SUMMARY OF OBJECTIVES

The remedial action objectives (RAOs) for the Site as defined in the OU1 ROD (NYSDEC, March 2008) are to eliminate or reduce to the extent practicable:

- Exposures of persons at or around the Site to VOCs in soil;
- Exposures of persons at or around the Site to VOCs in groundwater;
- Off-site migration of contaminants in groundwater;
- Discharge of contaminated groundwater to the Freeport Creek;
- The release of contaminants from soil into groundwater that may create exceedences of groundwater quality standards; and
- The release of contaminants from subsurface soil and groundwater into indoor air through soil vapor.

Furthermore, the remediation goals for the Site include attaining to the extent practicable:

- The NYSDEC Ambient Water Quality Standards (AWQS) and/or Guidance Values (GV) (June 1998);
- Soil cleanup goals in TAGM-4046 (Determination of Soil Cleanup and Objectives and Cleanup Levels) and 6 NYCRR Subpart 375-6 (Remedial Program Soil Cleanup Objectives);
- October 2006 New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York; and
- NYSDEC Surface Water Quality Standards.

This CCR addresses only soil vapor and indoor air. Measures to address soil, groundwater and surface water will be addressed in a Final Engineering Report (FER), to be submitted at a later date.

The Standards, Criteria and Guidance (SCGs) applicable to sub-slab vapor and indoor air at the Site are presented in **Table 2-1**, which reports the contaminants of concern as determined by the OU1 ROD for Site sub-slab soil vapor and indoor air along with their respective air guidelines.

Table 2-1: Sub-Slab Vapor and Indoor Air Contaminants of Concern and NYSDOH Air Guidelines

Contaminants of Concern	NYSDOH Air Guidelines (µg/m^3)[1]	NYSDOH Decision Matrix
1,1,1-Trichloroethane	Not available	Matrix B
Trichloroethene	2[2]	Matrix A
Tetrachloroethene	30[3]	Matrix B
cis-1,2-Dichloroethene	Not available	Matrix A

[1] NYSDOH (2006)
[2] Revised as of August 2015
[3] Revised as of September 2013

The primary guidance document governing soil vapor work in New York is the *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006; updated September 2013, August 2015 and May 2017). Two decision matrices have been developed as part of this guidance by the NYSDOH as risk management tools that provide specified actions based on the concentrations of individual compounds in the indoor air and sub-slab soil vapor. See Tables 2-2 and 2-3, respectively. The Site soil vapor contaminants are assigned one of two decision matrices: Matrix A (**Table 2-2**) or Matrix B (**Table 2-3**) based on the guidance. Four actions are possible from these matrices: no further action (NFA), identify and reduce (IR) sources within the structure, monitor (MO) of indoor air and sub-slab soil vapor, and mitigate (MI).

Table 2-2 NYSDOH Decision Matrix A

Sub-Slab Vapor (µg/m^3)	Indoor Air (µg/m^3)		
	< 0.2	0.2 to < 1	1 and above
< 6	NFA	NFA	IR
6 to < 60	NFA	MO	MI
60 and above	MI	MI	MI

NFA – No Further Action
IR – Identify and Reduce
MO – Monitor Only
MI – Mitigate

Table 2-3 NYSDOH Decision Matrix B

Sub-Slab Vapor (µg/m^3)	Indoor Air (µg/m^3)		
	< 3	3 to < 10	10 and above
<100	NFA	NFA	IR
100 to <1,000	NFA	MO	MI
1,000 and above	MI	MI	MI

See Table 2-2 for explanation of acronym/abbreviation

2.2 DESCRIPTION OF THE SELECTED REMEDY

The vapor intrusion risk at the Site was mitigated in accordance with the remedy selected by the NYSDEC in the 2008 ROD. The remedial actions were performed in accordance with the Sub-Slab Depressurization System Design (AECOM 2019d).

The factors considered during the selection of the remedy are those listed in 6NYCRR 375-1.8.

2.2.1 Summary of the ROD and the Selected Soil Vapor Remedy

The remedy selected by the NYSDEC to address SVI issues described in the March 2008 OU1 ROD for Site includes the following:

- The OU1 ROD reviewed the sub-slab vapor and indoor air sampling conducted at the Site in 2006. The following were the components of the selected remedy as specified in the ROD:

1. A remedial design program will be implemented to provide the details necessary for the installation, operation, maintenance, and monitoring of the remedial program.

2. Imposition of an institutional control in the form of an EE that will require (a) limiting the use and development of the property to commercial or industrial use (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) the property owner to complete and submit to the Department a periodic certification of institutional and engineering controls.

3. Development of a site management plan which will include the following institutional and engineering controls: (a) continued evaluation of the potential for vapor intrusion for any buildings developed on the Site, including provision for mitigation of any impacts identified; (b) monitoring of soil, soil vapor, groundwater and indoor air; (c) identification of any use restrictions on the Site; (d) vapor intrusion management, including but not limited to, an active SSDS in the existing building to prevent soil

vapor intrusion inside the building; and (e) provisions for the performance monitoring and continued proper operation and maintenance of the sub-slab depressurization system, including any required post-installation indoor air quality sampling.

4. The property owner, or designated representative, will provide a periodic certification of institutional and engineering controls, prepared and submitted by a professional engineer or such other expert acceptable to the NYSDEC, until the NYSDEC notifies the property owner in writing that this certification is no longer needed. This submittal will: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous certification or are compliant with Department-approved modifications; (b) allow the Department access to the Site; and (c) state that nothing has occurred that will impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the department.

5. The operation of the components of the remedy will continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

2.2.2 Pre-Design Study

The OU1 ROD requirement for an SSDS is based on VI sampling conducted in 2006. TACC ceased operation in 2004 and the Site has been vacant since then. ITW contacted NYSDEC in January 2019 to request enforcement of the ROD requirement because a party was interested in purchasing the property but would not be permitted to occupy the building without the SSDS in operation. To gather information for design of the SSDS, AECOM conducted a pre-design investigation (PDI). The PDI included additional radius of influence (ROI) testing and VI sampling in 2019. ROI testing was performed at nine locations in the Site building. The ROI tests consisted of drilling a hole through the slab, applying a vacuum and measuring the sub-slab vacuum at multiple distances and directions form the vacuum source. Vapor intrusion sampling included collection of sub-slab vapor samples from nine rooms and indoor air samples form three rooms, as well as an outdoor ambient air sample. In addition, AECOM obtained building architectural plans from the Freeport Building Department. Results were presented to NYSDEC and NYSDOH in a report dated April 2019 (AECOM 2019a). The PDI results indicated that:

- The concentration of 1,1,1-TCA and trichloroethene in the sub-slab vapor sample collected in Room 2, when applied to the NYSDOH Decision Matrices indicated that mitigation is necessary to prevent VI exposure to building occupants.

- Sub-slab vapor sampling results for 1,1,1-TCE, trichloroethene and cis-1,2-dichloroethene from Room 1 results suggested a possible need for monitoring or mitigation, depending on indoor air sample results. No indoor air samples

were collected in Room 1 and no other indoor air results, when combined with the Room sub-slab vapor results, indicated a need for mitigation. However, the building exterior is not airtight making results questionable.

- ROI testing indicated that in most areas of the building, good sub-slab communication was achieved and a ROI of at least 30 feet in at least one direction was observed at eight of ten test locations.

- The results of the methane evaluation were presented to NYSDEC Division of Environmental Remediation and Division of Material Management (DMM) and NYSDOH on October 30, 2019 in a separate submittal. Methane was not detected at any test location and no lower explosive limit (LEL) over 0% was measured. Although no methane was detected in sub-slab vapors during the evaluation, the system was designed to be explosion-proof, in the event methane is present at or above its LEL at some point in the future.

- Building plans showed that Rooms 2, 4 and 8 constituted an addition to the original building. Therefore, the sub-slab environment of these rooms is separated from the main part of the building by the building footing.

The Site building was constructed over a former municipal landfill. Therefore, the potential presence of methane in sub-slab vapors was also considered in the design of the SSDS. Per 6-NYCRR 363-9.7 c, any building constructed over an inactive landfill must include a methane monitoring system with continuous gas methane sensors installed inside the building that will trigger an audible alarm notification signal to emergency personnel when methane gas concentrations are detected; and periodic methane gas monitoring inside all buildings and underground utilities as per the DMM. ITW installed a methane monitoring system in the Site building that was activated in June 2020 (Woodard & Curran, 2020). The design of the SSDS takes into account the potential for sub-slab methane to be present beneath Rooms 2, 4 and 8. On October 29, 2019 AECOM conducted an evaluation of sub-slab methane at the Site. At 12 locations throughout the building, a hole was drilled through the slab, tubing was inserted into the hole and sealed, and the tubing was connected to a landfill gas meter, a 4-gas meter and a photoionization detector (PID). Methane was not detected at any test location and no lower explosive limit (LEL) over 0% was measured. The results of the methane evaluation were presented to NYSDEC and NYSDOH on October 30, 2019 in a separate submittal. Although no methane was detected in sub-slab vapors during the evaluation, the system was designed to be explosion-proof, in the event methane is present at or above its LEL at some point in the future.

Based on these findings, AECOM proposed to NYSDEC and NYSDOH to install the SSDS only in Rooms 2, 4 and 8, instead of the entire building In the event that future indoor air sample results from Room 1 indicate mitigation is needed, NYSDOH requested that contingency extraction points be installed in Room 1. The points would be installed through the slab, like those in Rooms 2, 4 and 8, but would be not be connected to the blower, but rather capped approximately 10 feet above the floor. The draft Design Report was submitted to NYSDEC and NYSDOH on June 5, 2019 (AECOM 2019b). Following multiple revisions, the Final Design Report was submitted on December 27, 2019 (AECOM 2019d).

The SVI remedy for this site was performed as a single project, and no interim remedial measures, operable units or separate construction contracts were performed.

Remedial activities completed at the Site were conducted in accordance with the NYSDEC-approved *Sub-Slab Depressurization System Design (*AECOM 2019d*)*. **Figure 2** provides an as built layout view of the SSDS layout. All deviations from the SSDS Design are noted below.

4.1 GOVERNING DOCUMENTS

4.1.1 Health and Safety Plan

All work performed during installation and operation of the SSDS at the Columbia Cement site was in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal Occupational Safety and Health Administration (OSHA). The site-specific Health and Safety Plan (HASP) (AECOM 2019c) was complied with for all remedial and invasive work performed at the Site. Furthermore, a designated Site Safety Officer (SSO) was present at the Site while operations were taking place. The Site Supervisor/SSO directed work operations in accordance with the SSDS Design and provided safety oversight in the field.

4.1.2 Community Air Monitoring Plan

Community air monitoring was conducted in accordance with the NYS DOH Generic CAMP (NYSDEC Technical Guidance for Site Investigation and Remediation [DER-10], Appendix 1A) in the vicinity of where the building slab was being cored. Air monitoring consisted of VOC monitoring with a photoionization detector (PID) and a dust monitor. In addition, a landfill gas meter was used to monitor for methane in the work zone. The PID, dust monitor and landfill gas meter were placed on a tripod adjacent to the work area. Readings were recorded in 15-minute intervals while work was being performed. No exceedances of the CAMP-specified action levels were observed Community Air Monitoring Program (CAMP) results are discussed in Section 4.2.5 of this document.

4.2 REMEDIAL PROGRAM ELEMENTS

4.2.1 Contractors and Consultants

The following list provides a summary of key project personnel, contractors, subcontractors and their associated tasks.

AECOM acted as both the environmental consultant and contractor for the project. AECOM provided design and consulting services, prepared project documents on behalf of Burmah Castrol Holdings, Inc. and provided field operation oversight for the remedial action installation. AECOM Construction Services performed the SSDS installation.

CorBuilt, LLC performed a sub-slab utility scan using electromagnetic induction and ground-penetrating radar. Ocean Electric connected the SSDS equipment to the building electric supply.

4.2.2 Site Preparation

Site preparation activities for the SVI mitigation system installation included the following activities:

- Visual survey of building interior to determine constructability as designed;
- Coordination of building owner for building access and clearing of debris outside the building;
- Obtaining a building permit from the Village of Freeport;
- A utility scan to identify sub-slab utilities and foundation structures.

The SSDS Design (AECOM, 2019d) provides a detailed account of the objective of the SSDS installation and operation. After the SSDS Design was accepted by NYSDEC and NYSDOH, full scale mobilization activities commenced. Documentation of agency approvals required by the SSDS Design is included in **Appendix B**. The Village of Freeport issued the Building Permit on January 7, 2020.

The sub-slab utility scan was performed by CorBuilt on January 15, 2020. CorBuilt utilized electromagnetic induction (EMI) and ground-penetrating radar (GPR) for the utility scan. The scan identified sub-slab sewer and electric lines, as well as thickened sections of concrete, grade beams and other foundation features. Some planned vapor extraction point locations were adjusted based on the results of the utility scan.

AECOM mobilized to the Site on January 20 to begin installation of the SSDS. AECOM staff reviewed the SSDS design, Health and Safety procedures and CAMP monitoring requirements. Equipment and material were delivered to the Site on January 20, 2020.

4.2.3 General Site Controls

The Site is a vacant building in a light industrial area. The Site building is not in use, but a neighboring business has an agreement with the property owner allowing for parking vehicles and storing equipment outside the building. The majority of the SSDS installation work took place inside the Site building so no additional control measures were required to secure the work area.

4.2.4 Nuisance Controls

The nature of the remedial action installation work did not cause any nuisances at the Site. As stated previously, most work occurred inside the Site building, isolated from the public. CAMP monitoring was implemented during all intrusive work to monitor for dust and odors relating to site work. The coring machine used to breach the building slab was equipped with a water source to control the dust during coring.

4.2.5 CAMP Results

CAMP monitoring was conducted during the slab coring work at the Site. Data was recorded at the specified intervals. There were no reported exceedances for the duration of the project. The landfill gas meter did not record data on all days but no action levels were exceeded on field spot checks and no methane was detected during the SSD installation. Copies of all recorded instrument data relating to the SSDS installation work are provided in **Appendix C**.

4.3 IMPLEMENTATION OF THE REMEDIAL PROGRAM

4.3.1 Installation of the SSDS

The SSDS extraction points and piping were installed between January 20, 2020 and February 4, 2020. The equipment shed was delivered to the Site on February 18, 2020 and was connected to the building electric supply on February 19, 2020. The system was started and tested on March 2, 2020. The vacuum monitoring points and pipe protectors were installed On February 3 and 4, 2020.

SSDS installation was initiated on January 20, 2020. The installation was performed by AECOM Construction Services. A photographic log of the installation activities is presented in Appendix A. The four-inch diameter poly vinyl chloride (PVC) piping was secured to walls and ceiling joists using clamps, pipe hangars and associated support hardware. As mentioned previously, some extraction point locations were adjusted based on the findings of the utility scan. The points were generally moved adjacent to the nearest wall or support column to avoid having to cross and possibly compromise grade beams.

The slab was cored with a 6-inch diameter core bit. The coring machine was equipped with a water source to suppress dust during coring. The CAMP station was positioned near the coring location. The CAMP station contained a photoionization detector to monitoring for VOCs, a dust monitor to monitor for airborne particulates and a landfill gas meter to monitor for methane. An LEL meter was also used in the work zone to monitor for methane from sub-slab vapors. No VOCs, particulates, or methane were detected during the intrusive work at the established action levels.

The sub-slab material consisted of aggregate overlying fine sand fill between the grade beams, with up to one inch of void space beneath the concrete. The concrete was approximately six inches thick in most places. At some locations in Rooms 2 and 4, the concrete slab is approximately 12 inches thick to support the manufacturing machinery used by Columbia Cement and TACC. Extraction point EP-07 is locate in one of the areas with 12 inches thick concrete.

The extraction points were constructed of PVC pipe flush with the bottom of the slab and sealed with cement caulk within the annulus and at the surface. At each extraction point, approximately one cubic foot of aggregate and sand was removed, and the space was backfilled with clean pea gravel in order to minimize the amount of dust that enters the systems. Steel pipe protectors were installed around the extraction point to protect them from damage during future site operations. Each extraction point was constructed with a ball valve which can be used to balance the system. Details of the extraction point construction are presented on **Figure 3**.

As described in Section 2.2.2, NYSDOH requested that contingency points be installed in Room 1 that could be connected to a blower at a later date, if sampling results indicate a need for mitigation. In accordance with the approved SSDS Design, seven additional extraction points were installed in Room 1. There were constructed like those in Rooms 2,4, and 8, but were capped 10 feet above the floor. A photographic log of the SSDS installation is presented in **Appendix D**.

The SSDS equipment shed was installed outside the building on February 17, 2020. The shed contained the blower and knockout tank. The blower is a Rotron® Model EN757F72XL sealed regenerative blower with an explosion-proof motor. The EN757F72XL is a 5.0 horsepower, 3-phase blower that operates at 60 Hz. It is capable of a maximum flow rate of 310 SCFM at 75 in. WC vacuum. The control panel attached to the equipment shed includes an autodialer to notify project personnel in the event of a system malfunction. The system was connected to the building electric supply on February 19, 2020. The connection was done by Ocean Electric of Freeport, New York, a licensed electrician. The equipment shed also contains an explosion-proof fan and an explosion-proof light fixture. A schematic diagram of the SSDS is presented on **Figure 4**.

Based on the February 2019 sub-slab vapor sampling results, no vapor treatment equipment was installed in the equipment shed. The exhaust from the SSDS is discharged to the atmosphere through a stack which has the following minimum characteristics in accordance with NYSDOH guidance:

- 12 inches above the roof of the building;
- 10 feet above the ground surface;
- 10 feet away from any window or opening that is less than two feet below the exhaust point; and,
- 10 feet from any other building, window, or building intake

The exhaust piping is equipped with a sample port to collect vapor samples. Exhaust piping is equipped with a ½-inch by ½-inch screen to prevent objects/animals from entering the piping system. A rain cover was installed on the exhaust stack to prevent moisture from entering the system and to prevent blockage from snow/ice.

As required by the NYSDOH, a visual pressure gauge was installed with the blower to allow for monitoring of system performance. The SSDS was fitted with a flexible U-tube manometer filled with red fluid with an expected life span of at least 10 years.

Rooms 2, 4 and 8 were inspected for the presence of cracks that might allow the intrusion of vapors or decrease system performance. No cracks larger than hairline cracks were observed. All readily accessible cracks were sealed with a non-shrink caulk to eliminate the vapor pathway between the indoor air and sub-slab vapor. The SSDS is connected to a dedicated electrical panel inside the Site building. The electrical circuit used to control the SSDS is labeled as "Sub-Slab Depressurization System".

4.3.2 Methane Monitoring System

ITW completed installation of the methane monitoring system required by 6-NYCRR 363-9.7 c and activated the system in June 2020 (Woodard & Curran 2020). The system is programmed with an initial alarm level of 15% LEL and a secondary alarm level of 25% LEL. The system is connected to the SSDS auto-dialer which will notify response personnel of any alarm or system malfunction. For all alarm conditions, a visible and audible alarm will alert building staff and the auto-dialer will notify response personnel. Upon notification of elevated methane levels, the building will be evacuated and ventilated. Building personnel will be allowed to re-enter the building only after continuously monitored LEL levels drop below 25% LEL. If methane levels exceed 25% LEL, the DMM of NYSDEC will be notified. The property owner is responsible for implementing the methane monitoring system OM&M program. ITW is responsible for OM&M on the system, but if the property is sold, the responsibility will transfer to the new owner. The regular OM&M program includes system confirmation of system operation, downloading and review of monitoring data, ambient air and sub-slab vapor LEL monitoring, and routine maintenance. An Operation, Maintenance and Monitoring Plan is

included in the Methane Monitoring System Installation Report and will be included in the SMP. The property is currently vacant. If the property is sold or becomes occupied, the list of response personnel and alarm notifications will be updated accordingly.

4.3.3 SSDS Operation

The system was started on March 3, 2020. After confirming air flow in the system, the auto-dialer was tested by simulating system errors. During the testing, the auto-dialer performed the proper notifications. To monitor the vacuum produced by the SSDS, Vapor Pin® sub-slab vapor monitoring points were installed at nine locations around the perimeter of Rooms 2, 4 and 8. The Vapor Pin ® locations were chosen to obtain measurements at the greatest distance from the extraction points within the treated area. The Vapor Pin ® locations are shown on Figure 2. After installation, vacuum measurements were made with a manometer and the Vapor Pins were also screened with a PID. Measurements are presented in Table 1. After almost six hours of operation, no vacuum measurement was measured in points VP-07 and VP-09. The vacuum in the remaining points ranged from -0.02 inches water column (in. WC) in VP-03 to -0.42 in. WC in VP-02. No VOCs were detected with the PID. Points VP-07 and VP-09 were located in a narrow space between a grade beam and the footing of the northern wall of the mitigated area. The points were relocated to the south side of the grade beam (approximately 4 feet from the northern wall). After relocation, the vacuum in VP-07 and VP-09 both measured -0.02 in. WC. At that point the vacuum readings in all of the Vapor Pins were all greater than the required -0.004 in WC. Vacuum readings were also made on March 18, 2020 and the vacuum readings ranged from -0.025 in WC in VP-03 to -0.395 in. WC in VP-02. The system measurements and vacuum readings taken on March 18, 2020 are presented in Tables 4-1 and 4-2, respectively.

Table 4-1: SSDS System Measurement – March 18, 2020

System Vacuum (in. WC)	17.5
System Flow (in. WC)	4.2
System Flow (cfm)	121
Effluent PID (ppm)	0.0

Table 4-2: Vacuum Measurements – March 18, 2020

Vapor Point	Vacuum (in. WC)	PID (ppm)
VP-01	0.095	0.0
VP-01	0.395	0.0
VP-03	0.025	0.0
VP-04	0.122	0.0
VP-05	0.030	0.0
VP-06	0.205	0.0
VP-07	0.039	0.0
VP-08	0.105	0.0
VP-09	0.210	0.0

See Figure 2 for vapor point locations

On March 18, after a round of vacuum readings, the SSDS was turned off. The impending property sale has not occurred, and the Site building remains empty. When the Site building is sold and/or becomes occupied on a regular basis, the SSDS will be restarted and a regular monitoring schedule will be established.

4.4 REMEDIAL PERFORMANCE/DOCUMENTATION SAMPLING

Remedial performance sampling will be performed on a regular schedule for on-site soil vapor to document concentrations of VOCs at the Site. SVI mitigation systems will be monitored for sub-slab pressure differentials on a quarterly basis at the nine vapor monitoring points in Rooms 2, 4 and 8.

In accordance with the SSDS Design, post mitigation indoor and outdoor air sampling will be conducted in all areas of the building where the SSDS is installed, as well as the other part of the building which will not contain an SSDS. As directed in The Guidance, air samples will be conducted at least 30 days after the completion of the SSDS, but no longer than the end of the next heating season (November 15 through April 15). Three indoor air samples and one outdoor ambient air sample will be collected in locations consistent with the pre-mitigation samples. In addition, a sample of the SSDS effluent will also be collected. Samples will be collected in 6-liter summa canisters over an 8-hour period and will be analyzed using EPA Method TO-15. NYSDOH Matrix A and C compounds will be analyzed using Method TO-15 SIM to attain a detection limit of 0.2 $\mu g/m^3$. All other compounds will have a detection limit of 1.0 $\mu g/m^3$. Samples will also be analyzed for methane by USEPA Method 18. Sample collection methods will be consistent with past methods and will continue to follow the guidelines set forth in The Guidance. Air concentrations will be tabulated, compared to NYSDOH air guidelines and analyzed to ensure that the SSDS is providing adequate protection of human health.

The Operation Maintenance and Monitoring (OM&M) Plan presented in **Appendix E** provides a detailed account of the monitoring and sampling requirements/procedures and operation and maintenance of the SSDS at the Site and will also be included in the SMP.

4.5 CONTAMINATION REMAINING AT THE SITE

4.5.1 Soil Vapor

During the 2019 PDI SVI sampling TCE was detected at 72 $\mu g/m^3$ in the sub-slab vapor in Room 2. 1,1,1-TCA was detected at 5,700 $\mu g/m^3$ in sub-slab vapor and at 3.3 $\mu g/m^3$ in indoor air in Room 2. These concentrations require mitigation per the NYSDOH decision matrices and are addressed by the SSDS. Trichloroethene (41 $\mu g/m^3$), cis-1,2-dichloroethene (9.2 $\mu g/m^3$) and 1,1,1-trichloroethane (350 $\mu g/m^3$) were detected in sub-slab vapor in Room 1. As discussed in Section 2.2.2, these values could indicate the need for monitoring or mitigation depending on paired indoor air sampling results. Indoor air in Room 1 will be sampled during the 2020-2021 heating season. Depending on sampling results, appropriate response measures will be taken to protect the health of building occupants. Groundwater in the spill area immediately east of Room 2 has concentrations of 1,1,1-trichloroethane, 1,1-dichloroethane and chloroethane at concentrations exceeding the NYSDEC Class GA Groundwater Standard of 5 µg/l, as well as soil with concentration of 1,1,1-trichloroethane, 1,1-dichloroethane and chloroethane at concentrations exceeding their respective NYSDEC Protection of Groundwater Soil Cleanup Objectives. These residual VOCs may continue to act as a source for sub-slab vapor in Room 2 for the near future

4.6 OTHER ENGINEERING CONTROLS

The implemented remedy for the site included the installation of the SSDS.

Procedures for monitoring, operating and maintaining the SSDS are provided in the Operation and Maintenance Plan submitted under separate cover and to be included in the SMP. The Monitoring Plan also addresses inspection procedures that must occur after any severe weather condition has taken place that may affect on-site ECs.

4.7 INSTITUTIONAL CONTROLS

Since remaining contamination exists at the Site, ICs are required to be implemented. The Site remedy requires that EEs be placed on the entire Columbia Cement Property. The purpose of the EEs are to (1) implement, maintain and monitor the ECs; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; and, (3) limit the use and development of the site to commercial/industrial uses only.

The EEs for the site were executed by the Department on May 8, 2020 and filed with the Nassau County Clerk on June 12, 2020. The County Recording Instrument number for this filing is 2020-00046221. A copy of the easements and proof of filing will be provided in the SMP.

The EEs, will be implemented to: (1) require compliance with the SMP; (2) restrict the use of groundwater as a source of potable or process water without the necessary water quality treatment as determined by NYSDOH; (3) require any new structures in the area of the groundwater contamination to include sub-slab construction that allows for the installation and operation of mitigation systems; and (4) require the property owner or designated representative to complete and submit to NYSDEC a periodic certification of institutional and engineering controls. The EE will be implemented for the entire property parcels (Tax Map IDs 230-62-65 and 230-62-85).

ICs identified in the EEs may not be discontinued without an amendment to or extinguishment of the EEs. Adherence to these ICs will be required by the EEs and will be implemented under the SMP.

These ICs are:

- All ECs must be operated and maintained as specified in the SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP;
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from NYSDEC;
- Any new structures in the area of the groundwater contamination shall include sub-slab construction that allows for the installation and operation of mitigation systems, or be constructed with vapor barriers incorporated into the slab;
- Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in the SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with the SMP;

- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in the SMP;

Access to all parcels addressed by the EE must be provided to agents, employees, or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the EEs.

Overall the installation of the SSDS were conducted as planned in the SSDS Design. The primary deviations were:

- Extraction point locations were moved from their planned locations. The points were moved from their planned locations to the nearest wall or column. This was done to avoid extending the sub-slab piping through grade beams which would require cutting the grade beams and compromising the building foundation. Also, the beam that point EP-09 was adjacent to had been cut and removed from the building, so EP-09 was relocated to the nearest beam on the north side of Room 2. The relocation of the extraction points did not affect the SSDS performance as all of the vapor monitoring points registered vacuum readings of greater than the required -0.004 in. WC during system operation.

- Vapor monitoring points VP-07 and VP-09 were relocated approximately two feet from their original locations. They were originally installed adjacent to the northern wall of Rooms 4 and 2, respectively. After SSDS startup, no vacuum was measured at either point. The points were installed in a narrow gap between the northern wall footer and a grade beam. The points were re-installed on the south side of the grade beam (about 4 feet from the wall) and registered the required vacuum.

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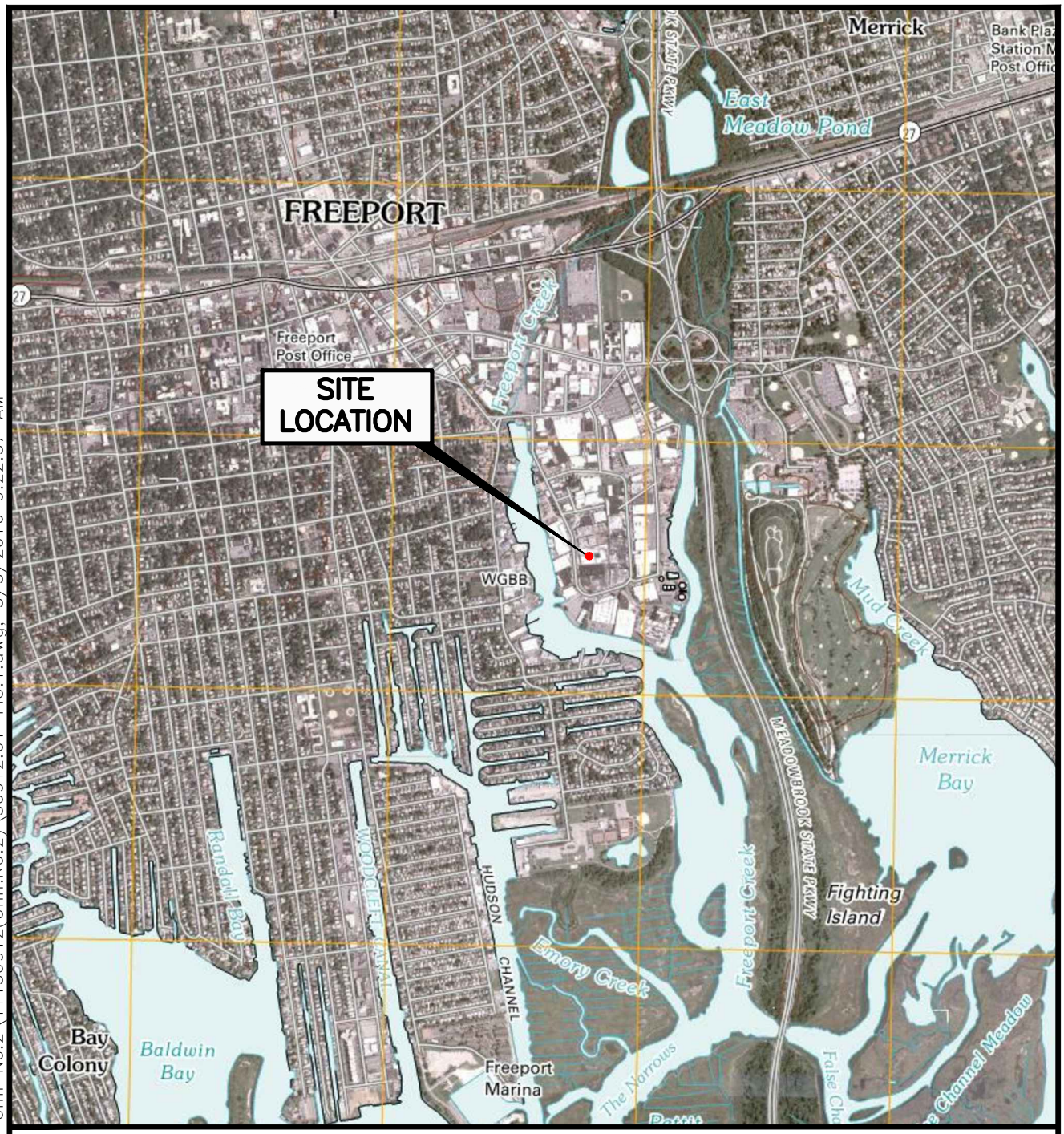
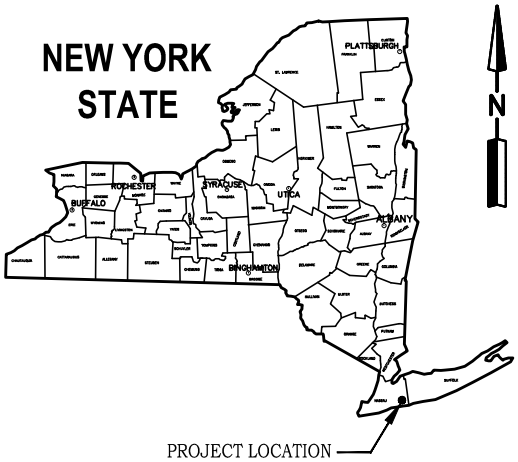
FIGURES





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0 2000 4000

SCALE IN FEET

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE:
FREEPORT, NY (2010)

SITE LOCATION MAP
FORMER COLUMBIA CEMENT COMPANY, INC.
SITE NO. 130052
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
1255 Broad Street
Clifton, New Jersey 07013
PHONE: (973) 883-8500
FAX: (973) 883-8501

DATE: 01/23/15

JOB: 11130912

FIGURE 1

K:\Cadd\Columbia Cement\Columbia Cement-Unit No.2\11130912(Unit.No.2)\30912.01-FIG.1.dwg, 5/5/2016 9:22:57 AM

Only copies from the original of this drawing that are marked with the original seal and signature of the Engineer, shall be considered as true valid copies.

WARNING
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NO.	MADE BY	APPROVED BY	DATE	DESCRIPTION

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DESIGNED BY: GW
DRAWN BY: DS
CHECKED BY: MB
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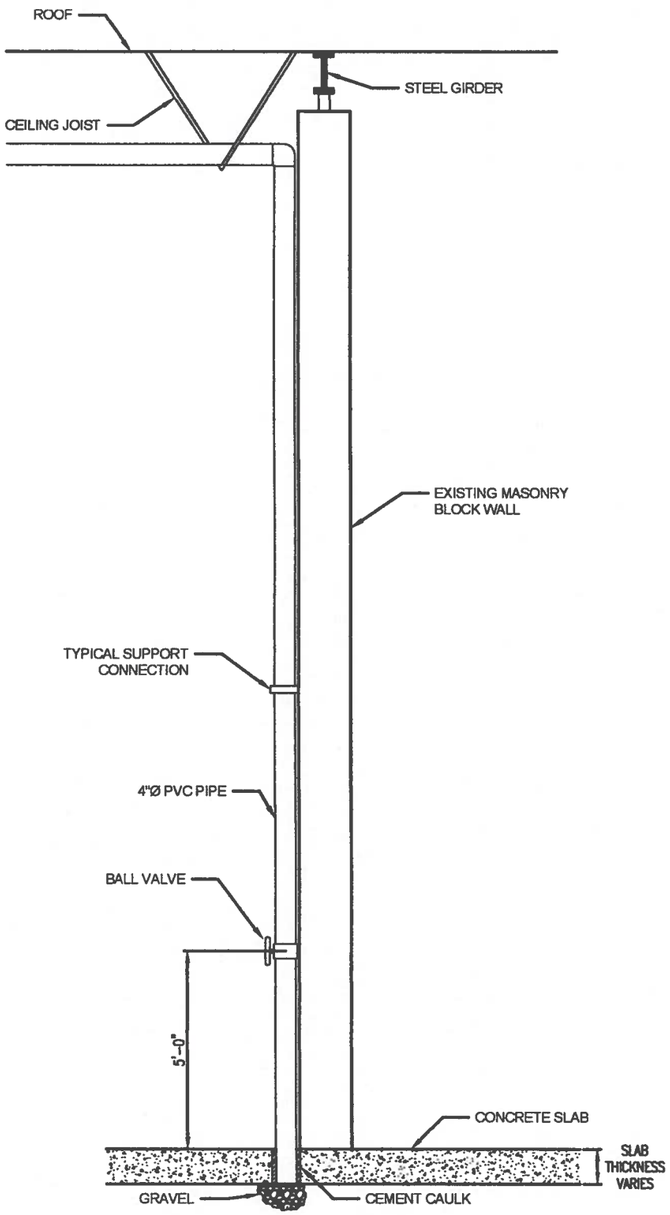
STATE OF NEW YORK
DANIEL T. SERVETAS
079068
LICENSED PROFESSIONAL ENGINEER
10/21/2020

COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION
SYSTEMS AS-BUILT
NYSDEC SITE 130052

SUB-SLAB DEPRESSURIZATION SYSTEM LAYOUT

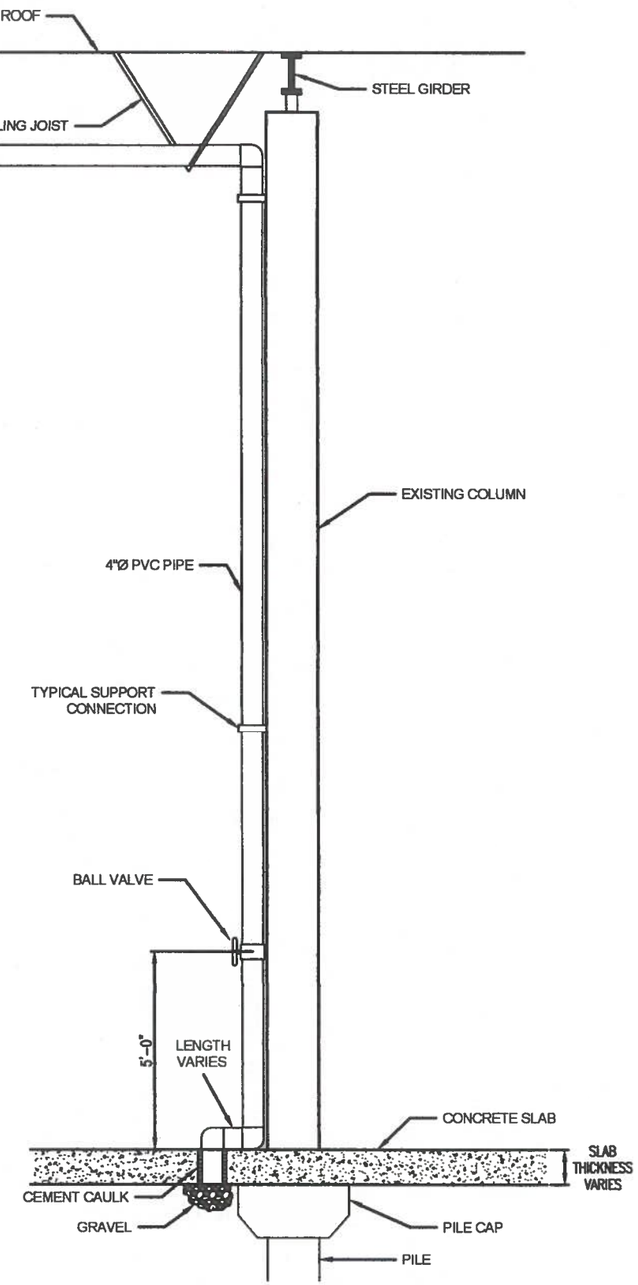
SCALE: 1" = 20' | DATE: JUN. 2020 | FIG. NO. 2



TYPICAL EXTRACTION POINT INSTALLATION DETAIL (TYPE 1)

1 | 3 8

NOT TO SCALE



TYPICAL EXTRACTION POINT INSTALLATION DETAIL (TYPE 2)

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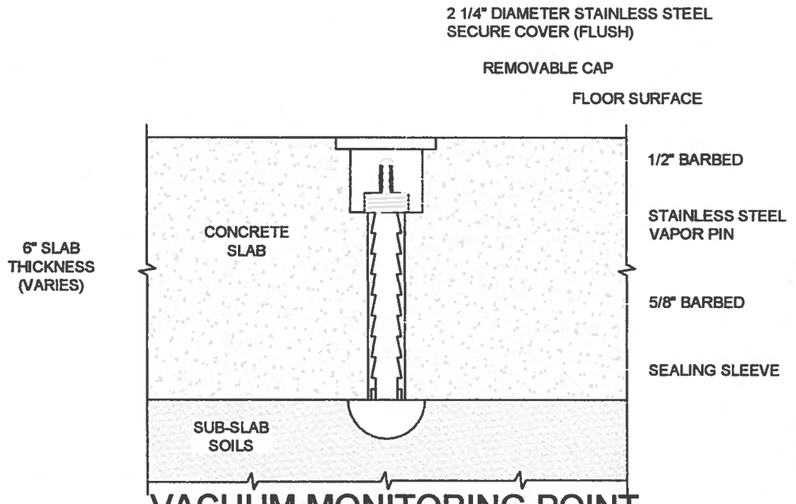

VACUUM MONITORING POINT DETAIL

NOTES:

1. ALL 4" ϕ PVC PIPE SHALL BE SUPPORTED EVERY 4' HORIZONTALLY AND EVERY 10' VERTICALLY.
2. ALL PIPES SHALL BE INSTALLED ABOVE EXISTING SPRINKLERS
3. BUTTERFLY VALVES AND SAMPLE PORTS SHALL BE LOCATED APPROXIMATELY 5 FEET ABOVE THE FLOOR.

NO.	BY	APPROVED BY	DATE	DESCRIPTION

REVISIONS

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DRAWN BY: DS
CHECKED BY: MB
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STATE OF NEW YORK · DANIEL T. SERVETAS · 079068 · LICENSED PROFESSIONAL ENGINEER

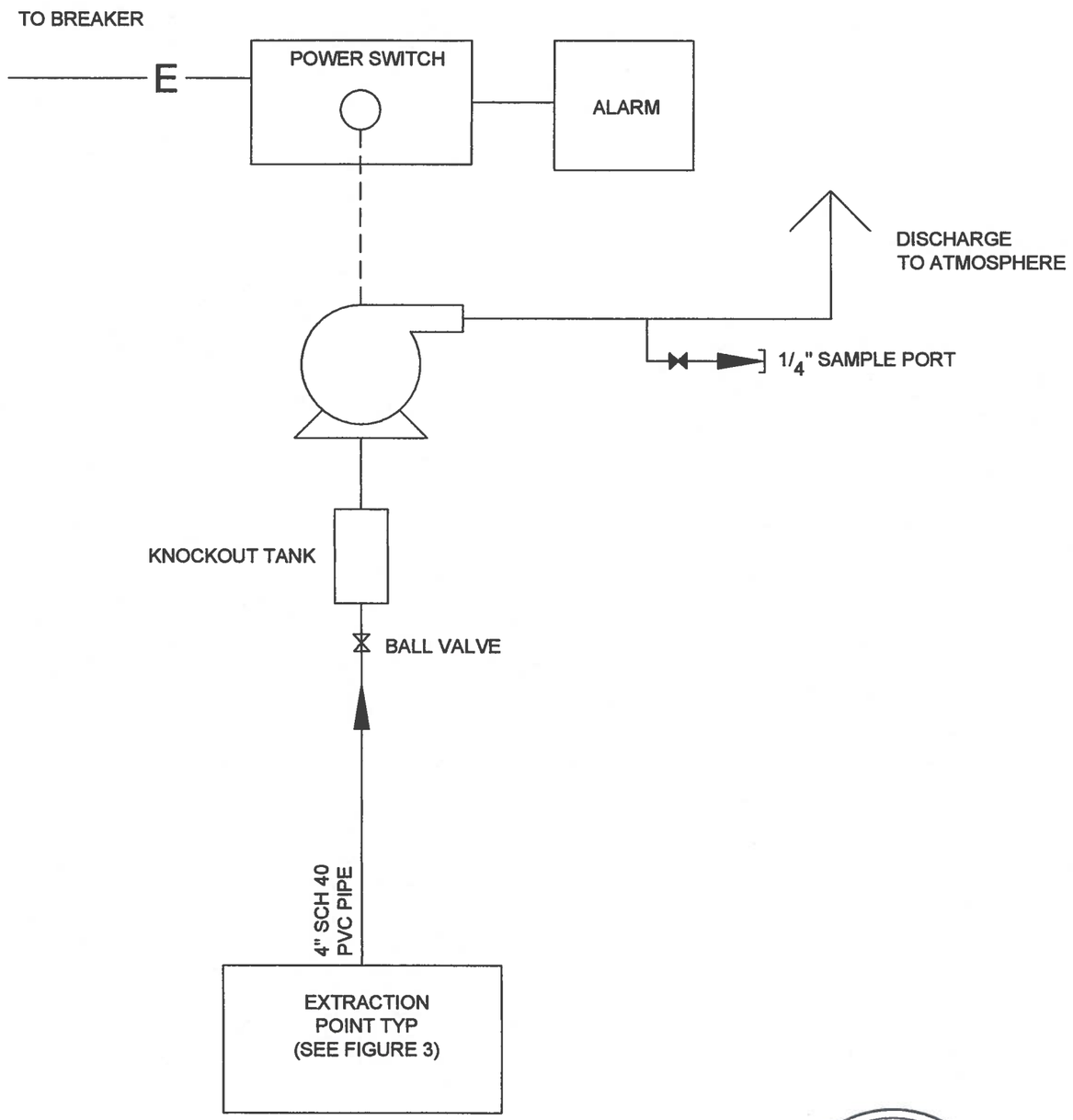
12/21/20

COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION SYSTEMS SCHEMATIC
NYSDEC SITE 130052

TYPICAL EXTRACTION POINT INSTALLATION DETAILS

DATE: SEP. 2020

FIGURE 3



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STATE OF NEW YORK
DANIEL T. SERVETAS
079068
LICENSED PROFESSIONAL ENGINEER
10/21/20

COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION
SYSTEMS SCHEMATIC
NYSDEC SITE 130052

PROCESS
DETAILS

DATE: SEP. 2020

FIGURE 4

APPENDIX E
OPERATION MAINTENANCE & MONITORING PLAN

OPERATION MAINTENANCE AND MONITORING PLAN
SUB-SLAB DEPRESSURIZATION SYSTEM

COLUMBIA CEMENT COMPANY SITE
159 HANSE AVENUE
FREEPORT, NEW YORK
SITE NO. 130052

Prepared for

Burmah Castrol Holding Company
201 Helios Way
Helios Plaza 6.370A
Houston, TX 77079

September 24, 2020

Prepared by

1255 Broad Street
Suite 201
Clifton, New Jersey 07013

Project No: 60481767

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

HVAC	heating, ventilation and air conditioning
in. Hg	inches of mercury
in. WC	inches of water column
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance and Monitoring
SSDS	sub-slab depressurization system
USEPA	U. S. Environmental Protection Agency
VOC	volatile organic compound

AECOM has prepared this Operation, Maintenance and Monitoring (OM&M) Plan on behalf of the Burmah Castrol Holdings, Inc., to serve as a guide for the operation and maintenance of the sub-slab depressurization system (SSDS) installed at the former Columbia Cement Company facility located at 159 Hanse Avenue in Freeport, New York ("Site" or "subject facility"). The SSDS was installed to address volatile organic compounds (VOCs) present in vapor beneath the building slab. These VOCs include 1,1,1-trichloroethane, tetrachloroethene, trichloroethene, 1,1-dichloroethene and cis-1,2-dichloroethene. A Site location map is presented as Figure 1. Specifically, this document addresses those activities necessary to ensure adequate performance of the SSDS following start up and necessary post-start up testing and diagnostics. This document also presents the monitoring requirements necessary to assure the SSDS is operating as designed and that sub-slab vapors are not adversely impacting indoor air at the Site.

As described in the SSDS Design (AECOM 2019), the system consists of nine vapor extraction points installed in Rooms 2, 4 and 8 of the Site building (Figure 2). Extraction point construction details are shown on Figure 3. The extraction points are connected to a blower in a shed outside the building. A schematic diagram of the SSDS is presented in Figure 4. The primary components of the system are described below.

- Extraction points:
  Description – 4-inch diameter schedule 40 PVC pipe penetrating the concrete slab.

  Purpose – The point at which air is removed from the sub-slab environment creating a negative pressure differential beneath the slab.

- Flow control valves:
  Description – 4-inch diameter schedule 40 PVC ball valves installed approximately five feet above each extraction point.

  Purpose – Allow for balancing air flow between the extraction points.

- Schedule 40 PVC Pipe and Fittings:
  Description – 4-inch diameter schedule 40 PVC Schedule 40 PVC pipe and fittings solvent welded to eliminate leaks. The piping was secured to walls, columns and ceiling joists with appropriate hardware.

  Purpose – To convey sub-slab vapors to the blower in the SSDS equipment shed.

- Equipment Shed:
  Description – A 10-feet by 8 feet shed outside the Site building.

  Purpose – Housing the mechanical components of the SSDS.

- Knockout Tank:
  Description – An 8-gallon tank with a drain.

  Purpose – To collect condensation prior to entering the blower.

- Blower:
  Description – A ROTRON® Model EN757F72XL regenerative blower with an explosion-proof motor.

  Purpose – To create a negative pressure differential beneath the slab and convey vapors the SSDS exhaust.

- Manometer and Flow Meter:
  Description – Gauges installed near the blower.

  Purpose – Measure vacuum and air flow generated by the blower.

- Effluent:
  Description – 4-inch PVC pipe and fittings with screened cap above the Site roof.

  Purpose – To convey vapors from the blower to a point above the building roof.

- Vapor Points:
  Description – Nine stainless steel Vapor Pin ™ sub-slab vapor monitoring ports.

  Purpose – Ports to measure sub-slab differential pressure or collect sub-slab vapor samples.

- Contingency Extraction Points:
  Description – Six extraction points installed in Room 1 that were not connected to a blower.

  Purpose – Extraction points that can be connected to a blower later in the event sampling data demonstrates a need for vapor mitigation in Room 1.

- Auto-Dialer:
  Description – Device in the control panel that sends automatic notifications to team members if certain alarm conditions are met.

  Purpose – Sends text messages to the AECOM project manager and OM&M technician in the event of power failure, a high level in the knockout tank or other condition that requires maintenance.

A core drill was used to core through the concrete slab for the installation of the extraction points, which were constructed of PVC pipe flush with the bottom of the slab and sealed with urethane caulk within the annulus and at the surface. Each extraction point was constructed with a ball valve which can be used to balance the system. The base of each extraction point is protected by a 40-inch tall steel pipe protector. The SSDS piping was run overhead and passed through the exterior wall and into an equipment shed before connecting to a knockout tank and a regenerative blower. An explosion-proof blower was selected as a precaution because of the potential presence of methane in the sub-slab vapors. The equipment shed is also equipped with an explosion-proof fan and light fixture. The exhaust from the SSDS is discharged to the atmosphere through a stack which has the following minimum characteristics

in accordance with New York State Department of Health (NYSDOH) guidance (NYSDOH 2006):

- 12-inches above the roof of the building;
- 10- feet above the ground surface;
- 10-feet away from any window or opening that is less than 2-feet below the exhaust point; and,
- 10-feet from any other building, window, or building intake.

Effluent piping is equipped with a ½-inch by ½-inch screen to prevent objects/animals from entering the piping system.

All readily accessible cracks were sealed with a non-shrink caulk to eliminate the vapor pathway between the indoor air and sub-slab vapor. The electrical circuit used to control the SSDS equipment is labeled as "Sub-Slab Depressurization System". The SSDS control panel is equipped with an auto-dialer programmed to notify operators in the event of system malfunctions.

A total of nine soil vapor monitoring points were installed in the Rooms 2, 4 and 8. These locations were distributed throughout the treated portion of the building, allowing monitoring of vacuum distribution beneath the slab and collection of sub-slab vapor samples. Permanent sampling points were installed at each of the locations utilizing the VaporPin™ system. This system includes a stainless-steel barbed fitting with a silicone sleeve which is permanently installed in the slab and capped when not in use. A stainless-steel secured cover is installed over the barb fitting flush with the finished floor.

During the subsequent discussions please refer to Figures 3 and 4, which illustrate the general location of the system components and airflow directions for the SSDS since its initial activation in March 2020.

In order to activate the SSDS the following steps are required:

1.) Turn on the circuit breaker within the distribution panel at the main power supply.

2.) Activate the power switch on the control panel on the SSDS equipment shed.

5.) Confirm that all isolation valves on all suction points are open.

6.) Verify vacuum at each vapor monitoring point and compare it to its initial reading.

The SSDS blower will activate and remove air from the sub-slab environment. Vacuum readings and/or air flow measurements should be confirmed throughout the comprehensive system through installed monitoring points. This data should be compared to data collected during the initial performance verification event that took place post start up. If there is a discrepancy, additional inspection and performance monitoring should be conducted.

Continuous operation of the SSDS is required in order to maintain negative pressure beneath the slab to prevent possible vapor intrusion. In general, maintenance to the individual system components is not necessary given their inherent design and intent. The SSDS does not include vapor treatment equipment, so management of treatment media is not required. Routine inspection of the individual extraction points, overall systems and building conditions are an essential part of maintaining the system. Inspections should be conducted on a quarterly basis to help ensure the SSDS operates continuously and reliably throughout its lifecycle. To streamline the inspection process and ensure consistency between inspection events, a site-specific inspection form has been prepared to document the findings. This form includes spaces to document any abnormalities identified and concerns that tenants, property owners and/or other stakeholders may have. The results of the system inspections should be incorporated into operations and maintenance reports. The list provided below in Table 1 includes general elements of the system inspections.

TABLE 1 – GENERAL ROUTINE SYSTEM INSPECTIONS

DESCRIPTION	VERIFY	ACTION
Isolation Valves	Each valve is open or set to position as determined through post start up performance verification.	Actuate valves to ensure they function and verify valve position.
Vacuum Monitoring Points	Use a manometer to confirm that a differential pressure of -0.004 in. WC is maintained at each point.	If necessary, actuate valves on extraction points to balance the vacuum to required levels.
Conveyance Pipe and Fittings	Visually inspect all pipe and fittings to ensure they are tight, intact and are pitched correctly to drain condensate to extraction points	Broken or separated pipe and fittings will require repair or replacement. Sagging pipes will require additional or new support.
Blower	Ensure blower is fully functional	Confirm the blower has power and all circuits and switches are activated. If blower does not function return it to the manufacturer for diagnoses and possible warranty coverage or consider replacement.
Cracks and Gaps	Visually inspect sealed cracks, gaps and seals at suction points.	Note the size and location of visible cracks and gaps that have not been sealed or where seal integrity may be compromised. Apply sealant or re-seal as necessary.
Labels	Ensure all SSDS labels are intact and up to date	Replace damaged, worn or missing labels
Exhaust Stack	Visually inspect fan exhaust stack to ensure there are no obstructions	Document ice buildup and/or rodent or bird problems. Remove and consider long term mitigation needs if either problem persists.

When the SSDS system is started, the routine maintenance activities presented in Table 1 shall be performed weekly for four weeks, then monthly for two months. After the first three months of operation are completed, the inspections will be conducted on a quarterly basis. A routine system inspection form is presented in Appendix A.

Non-routine inspection and maintenance may also be required given the following situations:

- The owner or occupants report that the system is either not functioning properly or are indicating a loss or increase in vacuum;
- The SSDS becomes damaged; or
- The building undergoes renovations that may reduce effectiveness of the system. This may include the following:
    - changes in the community (surrounding land use);
    - changes in building use/occupants;
    - changes in building structure (additions, etc.) and,
    - changes in heating, ventilation and air conditioning (HVAC) system/operations or installation of a new combustion or vented appliance of equipment.

Periodic indoor air monitoring will be required to ensure that the SSDS is operating in a manner that is protective of the health of building occupants. The monitoring program will include indoor air and SSDS effluent sampling. The components of the monitoring program are described below.

6.1 INDOOR AIR MONITORING

The indoor air sampling will be done in accordance with the *Guidance for Evaluating Vapor Intrusion in the State of New York, with updates* (*SVI Guidance*) (NYSDOH 2006). All doors and windows will be closed prior to sampling. It should be noted that, as of the time of this OM&M plan preparation, that based on roof leaks, boarded-up windows and rusted doors, the building is not currently air-tight.

Indoor air samples will be collected by placing a 6-liter, individually certified Summa canister at breathing level (3 to 5 feet above the floor). The Summa canisters will be equipped with flow controllers set to collect the samples over an 8-hour period. The 8-hour sampling period assumes that when the facility is in operation, it operates with a single 8-hour shift. In accordance with the *SVI Guidance*, if the facility operates with multiple shifts, the sampling period will be adjusted accordingly. To start sample collection, the indoor air sample valve will be opened. At the locations where paired indoor air sample and sub-slab vapor samples are collected, the samples will be initiated at approximately the same time, so they are collected over the same time period. During the 8-hour sampling period, the vacuum reading will be monitored periodically, and the ambient temperature and pressure will be recorded on the sampling data sheet. The sampling will be completed when the vacuum in the Summa canister measures between 5 and 10 inches of mercury (in Hg). At this point the valve on the canister will be closed.

To evaluate contributions of VOCs from outdoor air, during each indoor air sampling event, one outdoor ambient air sample will be collected concurrently with the indoor air samples. A 6-liter Summa canister with a flow controller set to collect the samples over an 8-hour period will be place in a secure outdoor location at breathing height (3 to 5 feet above the ground). The valve will be opened to begin sample collection. During the 8-hour sampling period, the vacuum reading will be monitored periodically. The sampling will be completed when the vacuum in the Summa canister measures between 5 and 10 inches of mercury (in Hg). At this point the valve on the canister will be closed.

One duplicate sample will be collected during each sampling event. After the completion of sampling, the Summa canisters will be submitted under chain of custody documentation to a NYSDOH ELAP-certified laboratory and will be analyzed for volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15 with ASP Category B deliverables. Samples will be analyzed at an expedited turnaround time. The

laboratory will be capable of reporting *SVI Guidance* Matrix A and C compounds to 0.20 µg/m^3, and all other compounds to 1.0 µg/m^3.

6.1.1 Post-Startup Indoor Air Sampling

After the SSDS has been in operation for 30 days continuously, indoor air samples will be collected in the treated portion of the Site building to evaluate whether the SSDS is effectively mitigating vapor intrusion. Three indoor air samples will be collected; one each in Rooms 2, 4 and 8. Sampling locations are shown on Figure 5. If sample results indicate VOCs are present in indoor air above applicable NYSDOH Matrix values, the source of the VOCs will be investigated.

6.1.2 Annual Indoor Air Sampling

Indoor air samples will be collected annually during heating season to evaluate whether vapor intrusion is impacting the untreated portions of the building. Samples will be collected in Room 1, Room 3, Room 5 and Room 11. Sample locations are shown on Figure 5. During 2019 VI sampling, VOCs were detected in sub-slab vapor in Room 1, which is immediately north of the spill area. Room 3 is a large central room. Room 5 is adjacent to Room 2 and immediately west of the spill area. Room is an office in the northwest corner of the building. With the exception of Room 11, most room are connected by doorways large enough to support forklift traffic. There is ample air flow between these rooms, so these sample locations should be sufficient to characterize indoor air in the building. Therefore, samples collected in Rooms 1, 3, 5 and 11 would be representative of the untreated portion of the building. Additional samples in Rooms 6, 7, 9 and 10 are not necessary.

6.2 EFFLUENT SAMPLING

The SSDS effluent stream will be sampled to confirm vapor treatment is not needed prior to discharging to the atmosphere. An effluent sample will be collected within 24 hours of system startup. The effluent sample will be analyzed for VOCs by USEPA Method TO-15 and for methane by USEPA Method 18 with a 24-hour turnaround time. Sample results will be compared to Division of Air Resources, Annual Guidance Concentrations and Short-Term Guidance Concentrations. If sample results exceed applicable guidance concentrations, the system will be stopped, and effluent treatment will be added to the effluent line.

After the initial system startup effluent sample, an effluent sample will be collected annually with the annual indoor air samples. These effluent samples will be analyzed for VOCs by USEPA Method TO-15 and for methane by USEPA Method 18 with standard turnaround time.

The sampling program is summarized in Table 2.

TABLE 2 - SUMMARY OF SAMPLING PROGRAM

SAMPLE MATRIX	LOCATION	TIMING / FREQUENCY	ANALYTICAL PARAMETERS
Indoor Air	Rooms 2, 4 and 8 and ambient air	30 days after system startup	VOCs by USEPA Method TO-15/TO-15 SIM, Methane by USEPA Method 18
Indoor Air	Rooms 1, 3, 5 and 11 and ambient air	Annually during heating season	VOCs by USEPA Method TO-15/TO-15 SIM, Methane by USEPA Method 18
SSDS Effluent	SSDS Effluent Port	Within 24 hours of system startup	VOCs by USEPA Method TO-15, Methane by USEPA Method 18 (24-hour turnaround time)
SSDS Effluent	SSDS Effluent Port	Annual	VOCs by USEPA Method TO-15, Methane by USEPA Method 18 (standard turnaround time)

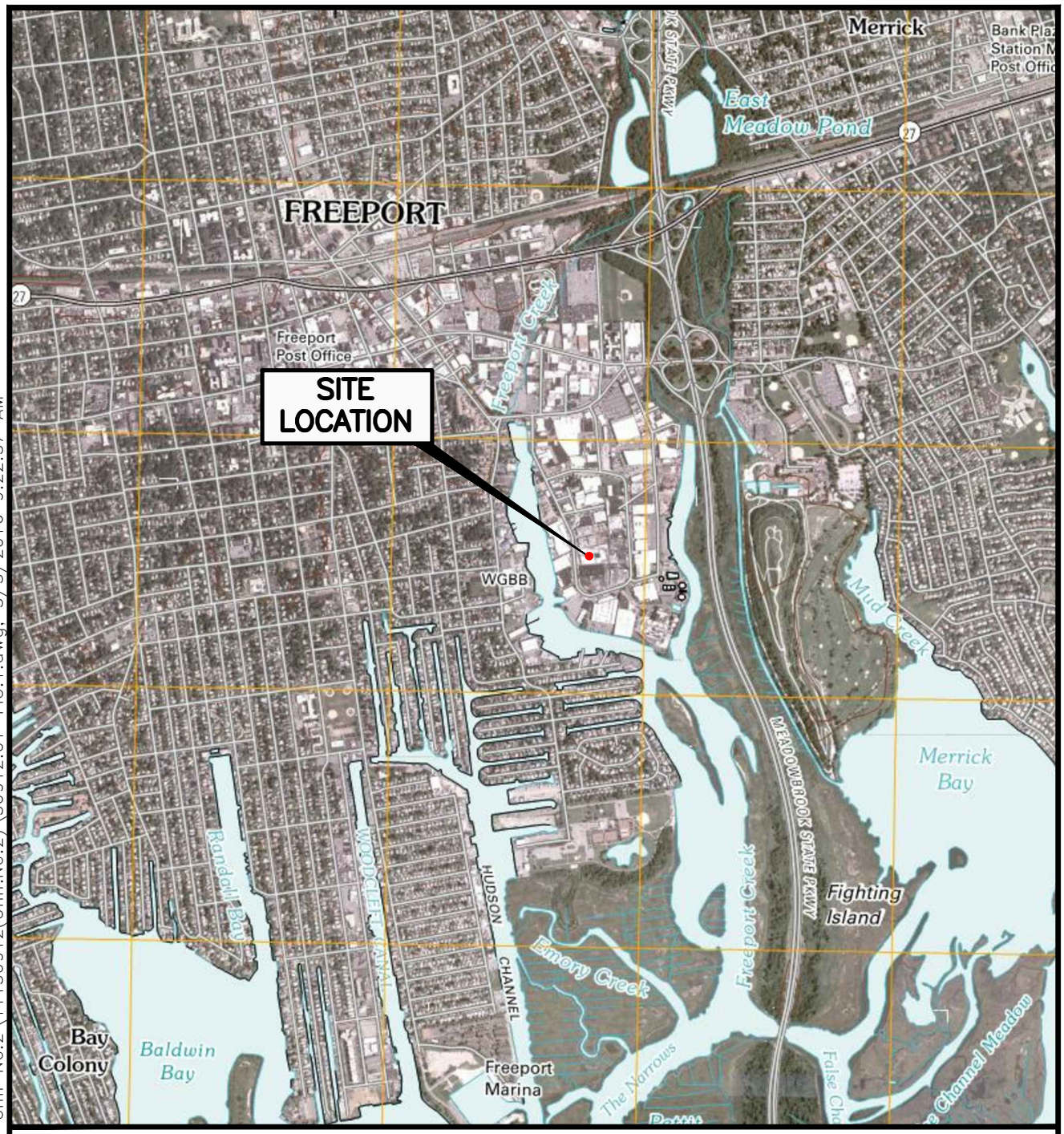
6.3 REPORTING

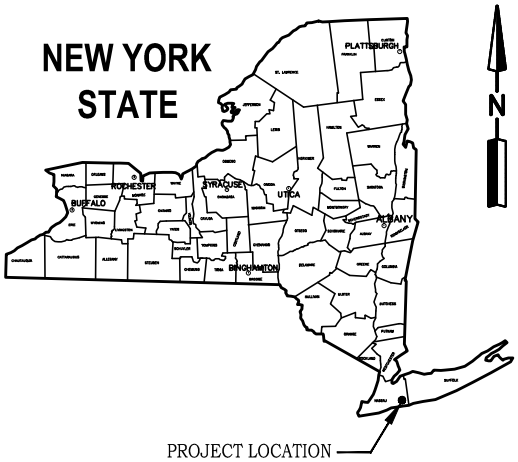
The quarterly system operation and sub-slab vacuum measurements will be reported to the New York Department of Environmental Conservation (NYSDEC) and NYSDOH on a quarterly basis within two weeks of the inspection and measurements. The post-startup indoor air sampling results and the annual indoor air and effluent sampling results will be reported to NYSDEC, NYSDOH and the property owner within two weeks of receipt of validated laboratory data. The post-startup effluent sample results will be conveyed to NYSDEC and NYSDOH upon receipt of preliminary sampling results and confirmed upon receipt of validated laboratory data.

AECOM, 2019. Sub-Slab Depressurization System Design, Former Columbia Cement Company Facility, Site No. 130052. December 2019.

NYSDOH, 2006. New York State Department of Health Guidance for Evaluating Soil Vapor intrusion in the State of New York. October 2006 (and updates).

FIGURES





N

0 2000 4000

SCALE IN FEET

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE:
FREEPORT, NY (2010)

SITE LOCATION MAP
FORMER COLUMBIA CEMENT COMPANY, INC.
SITE NO. 130052
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
1255 Broad Street
Clifton, New Jersey 07013
PHONE: (973) 883-8500
FAX: (973) 883-8501

DATE: 01/23/15

JOB: 11130912

FIGURE 1

K:\Cadd\Columbia Cement\Columbia Cement-Unit No.2\11130912(Unit.No.2)\30912.01-FIG.1.dwg, 5/5/2016 9:22:57 AM

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NO.	MADE BY	APPROVED BY	DATE	DESCRIPTION

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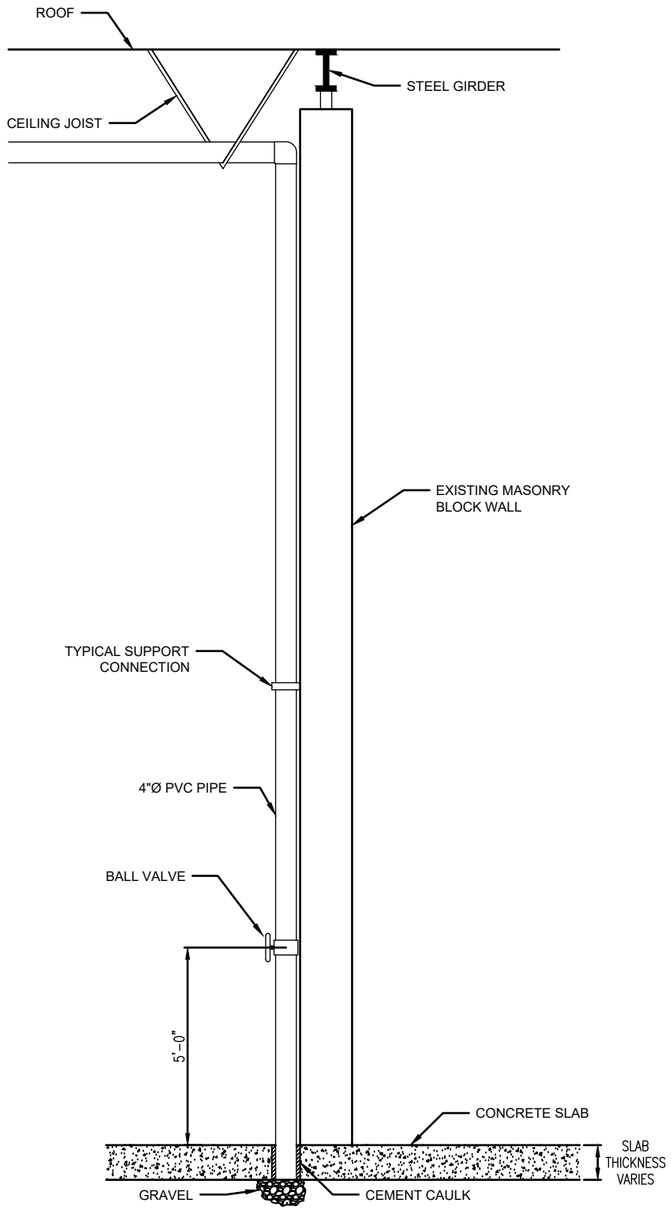
(518) 951 - 2200

JOB NO. 60481767

COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION
SYSTEMS AS-BUILT
NYSDEC SITE 130052

SUB-SLAB DEPRESSURIZATION
SYSTEM LAYOUT

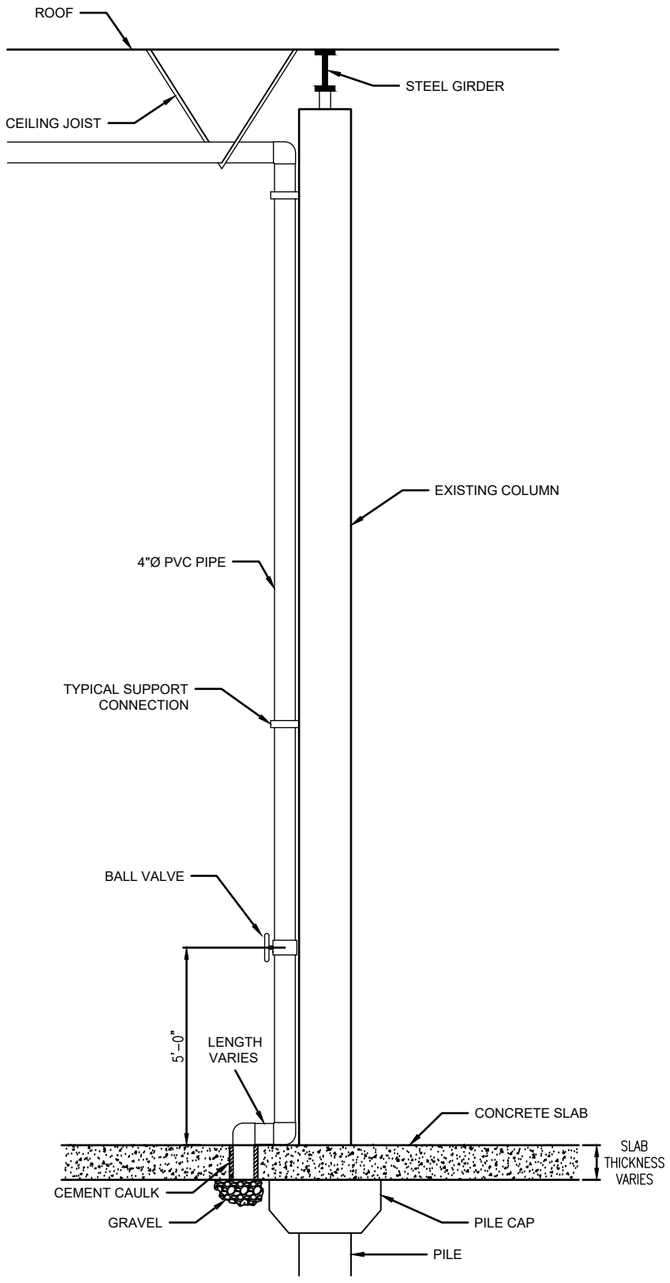
SCALE : 1" = 20'	DATE: JUN. 2020	FIG. NO. 2



TYPICAL EXTRACTION POINT INSTALLATION DETAIL (TYPE 1)

1
3 | 8

NOT TO SCALE



TYPICAL EXTRACTION POINT INSTALLATION DETAIL (TYPE 2)

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3 | 8

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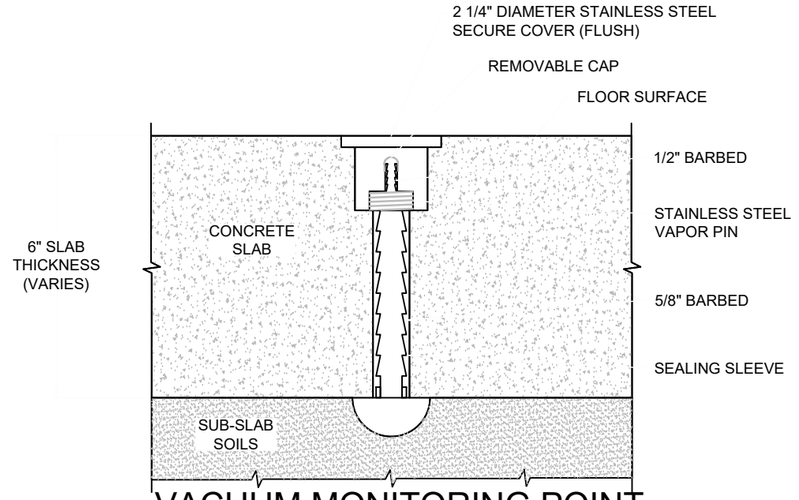

VACUUM MONITORING POINT DETAIL

NOTES:

1. ALL 4" ϕ PVC PIPE SHALL BE SUPPORTED EVERY 4' HORIZONTALLY AND EVERY 10' VERTICALLY.
2. ALL PIPES SHALL BE INSTALLED ABOVE EXISTING SPRINKLERS
3. BUTTERFLY VALVES AND SAMPLE PORTS SHALL BE LOCATED APPROXIMATELY 5 FEET ABOVE THE FLOOR.

NO.	MADE BY	APPROVED BY	DATE	DESCRIPTION

REVISIONS

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CHECKED BY: MB
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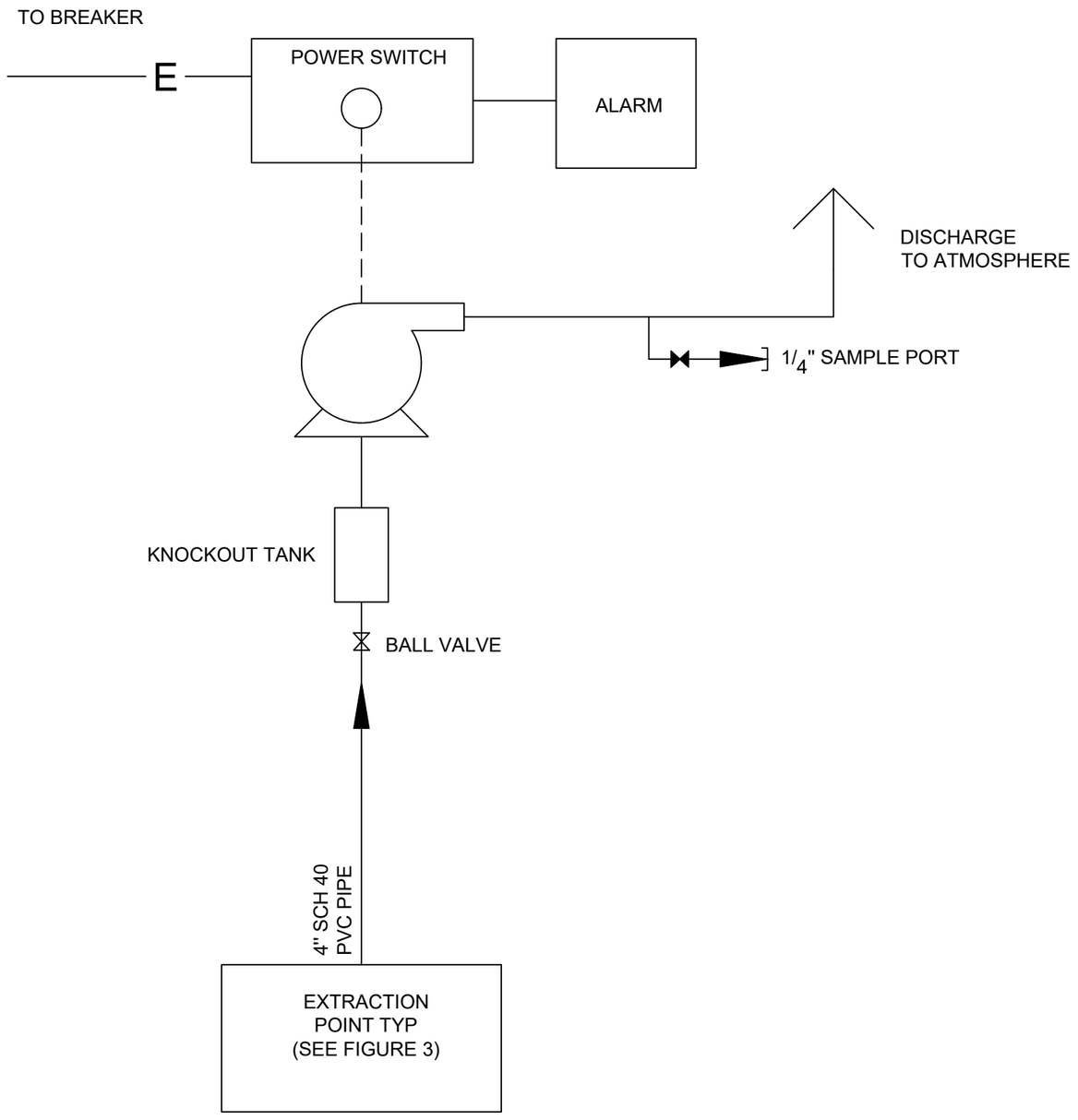
COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION
SYSTEMS SCHEMATIC
NYSDEC SITE 130052

TYPICAL EXTRACTION POINT INSTALLATION DETAILS

DATE: SEP. 2020

FIGURE 3



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COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION
SYSTEMS SCHEMATIC
NYSDEC SITE 130052

PROCESS
DETAILS

DATE: SEP. 2020

FIGURE 4

LEGEND

	STORM DRAIN LINE
MW-98-9D	MONITORING WELL LOCATION
VP-01	VACUUM MONITORING POINT
EP-01	ACTIVE SUB-SLAB VAPOR EXTRACTION POINT (CONNECTED TO SYSTEM)
EP-10	CONTINGENCY SUB-SLAB VAPOR EXTRACTION POINT (NOT CONNECTED TO SYSTEM)
	POST-STARTUP INDOOR AIR SAMPLING LOCATION
	ANNUAL INDOOR AIR SAMPLING LOCATION

Only copies from the original of this drawing that are marked with the original seal and signature of the Engineer, shall be considered as true valid copies.

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COLUMBIA CEMENT
SUB-SLAB DEPRESSURIZATION SYSTEM
NYSDEC SITE 130052

INDOOR AIR SAMPLING LOCATIONS

SCALE : 1" = 20' | DATE: JUL. 2020 | FIG. NO. 5

This drawing was computer generated. Any changes and/or revisions should be made to the CADD drawing file.

APPENDIX A
SSDS INSPECTION FORM

Columbia Cement SSDS OM&M Form

Date:		Personnel:		System Operating? Y / N

System Readings:						
System Vacuum	System Flow		PPM	Time	Hour Meter	Inches of water in K/O Tank
inwc	inwc	cfm	Effluent PID			

VP-09		VP-08		VP-07		VP-06		VP-05		VP-04		VP-03		VP-02		VP-01	
Vac	PID	Vac	PID	Vac	PID	Vac	PID	Vac	PID	Vac	PID	Vac	PID	Vac	PID	Vac	PID

Vac readings are in (inwc) PID readings are in (ppm)

Notes:

AECOM
1255 Broad Street, Suite 201
Clifton, New Jersey 07013

973-883-8500 tel
973-883-8501 fax

July 27, 2021

Mr. Girish Desai
Division of Environmental Remediation
New York State Department of Environmental Conservation
Building 40 – SUNY, Stony Brook
Stony Brook, New York 11790-2356

Subject: Columbia Cement Site, Freeport, Nassau County, New York
NYSDEC Registry Site No. 130052
Revised Emerging Contaminants Monitoring Work Plan

Dear Mr. Desai:

On behalf of BP UK Retained Holdings, AECOM Technical Services, Inc. (AECOM) has prepared this Revised Emerging Contaminants Monitoring Work Plan (Work Plan) for the Columbia Cement Site (Site) in Village of Freeport, Town of Hempstead, New York (Figure 1 – Site Location Map). On November 24, 2020 NYSDEC directed AECOM to perform various tasks at the Columbia Cement Site. These tasks included collecting and analyzing groundwater samples for emerging contaminants in accordance with recent NYSDEC guidance documents.

Background

In 2017, the New York State Department of Environmental Conservation (NYSDEC) undertook a state-wide evaluation of 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS) in state groundwater. This initiative was undertaken because these “emerging contaminants” (ECs) had been found in drinking water supplies in New York. As directed by NYSDEC, AECOM collected samples for 1,4-dioxane and PFAS compounds during the March 2017 Operable Unit No. 2 (OU-2) groundwater sampling event and the September 2017 Operable Unit No. 1 (OU-1) and OU-2 groundwater sampling event. PFAS compounds and 1,4-dioxane were detected in OU-1 and OU-2 groundwater.

NYSDEC had no Groundwater Quality Criteria for these emerging contaminants at the time of sampling, so results were compared to applicable United States Environmental Protection Agency (EPA) Health Advisory Levels. The Health Advisory Level for 1,4-dioxane was 0.35 micrograms per liter (µg/l). The Health Advisory Level for the PFAS compounds perfluorooctanoic acid (PFOA) and perfluorooctanesulfonate (PFOS) was 70 nanograms per liter (ng/l) for each compound. 1,4-dioxane was detected in OU-1 groundwater at concentrations ranging from 1.3 µg/l to 69 µg/l. PFOA was detected in OU-1 groundwater at concentrations ranging from 20 ng/l to 2,300 ng/l and PFOS was detected in OU-1 groundwater at concentrations ranging from 38 ng/l to 1,300 ng/l. 1,4- dioxane was detected in OU-2 groundwater at concentrations ranging from 0.24 µg/l to 29 µg/l. PFOA was detected in OU-2 groundwater at concentrations ranging from 1.7 ng/l to 210 ng/l and PFOS was detected in OU-2 groundwater at concentrations ranging from 2.4 ng/l to 200 ng/l. In August 2020, NYSDOH adopted drinking water standards for 1,4-dioxane (1 µg/l), PFOA (10 ng/l) and PFOS (10 ng/l). Groundwater in the vicinity of the Site is not utilized as a drinking water source. The 2017 PFOA, PFOS and 1,4-dioxane groundwater analytical results are presented in Table 1.

1,4-Dioxane has historically been used as a stabilizer for 1,1,1-trichloroethane (1,1,1-TCA), which was used by Columbia Cement during Site operation. The 1988 spill of 1,1,1-TCA could be the source of the 1,4-dioxane impacts. However, PFAS contamination is not generally associated chlorinated solvent use.

PFAS is often associated with aqueous film forming foam (AFFF) used in firefighting. It is not known if Columbia Cement (or successor TACC) used AFFF at the Site.

NYSDEC has requested that AECOM collect groundwater EC data in accordance with current NYSDEC guidance documents. This Work Plan presents a scope of work to assess current PFAS concentrations onsite and evaluate groundwater flow directions.

Scope of Work

To meet NYSDEC's requirement to evaluate the current concentrations and distribution of PFAS and 1,4-dioxane at the Site and off-Site, AECOM will perform a scope of work that includes:

- Review of historical information to assess potential PFAS sources;
- Repair and/or replacement of select damaged wells at OU-1 and OU-2;
- Monitoring groundwater levels at the Columbia Cement site and Freeport Creek over multiple tidal cycles; and
- Collection of groundwater samples.

Samples will be collected and analyzed in accordance with the guidance information included with the January 2021 NYSDEC guidance document *Sampling, Analysis and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs* (NYSDEC PFAS Guidance Document, January 2021).

The above summarized scope of work is presented in more detail in the following sections.

Historical Document Review

AECOM will review historical documents related to both 159 Hanse Avenue and 272 Buffalo Avenue for indications of historical use of PFAS-containing substances. As PFAS is an "emerging contaminant," it is unlikely that historical documents contain relevant information. AECOM has submitted a Freedom of Information Law (FOIL) request to NYSDEC for information on environmental investigations and remediation at 272 Buffalo Avenue. AECOM has also obtained a historical environmental data base for 272 Buffalo. This information will be reviewed, and any relevant findings will be presented to NYSDEC. AECOM has also submitted a FOIL request to the Village of Freeport for any records related to fires at 159 Hanse Avenue and whether AFFF was used to fight the fire(s). Any relevant findings from the FOIL request will be presented to NYSDEC.

Utility Clearance

AECOM will employ multiple measures to prevent contact with subsurface utilities during drilling. Prior to any drilling activities, AECOM's drilling contractor will request a utility markout from the New York "Dig-Safe" service for the drilling area. AECOM will also retain a private utility locator who will use ground-penetrating radar and electromagnetic methods to scan the drilling areas for subsurface utilities. In addition, each boring location will be cleared to a depth of five feet with a hand auger or other non-mechanical means. If conflicts with subsurface or overhead utilities are discovered, the boring location will be moved accordingly.

Monitoring Well Repair / Replacement

Some OU-1 and OU-2 monitoring wells have been damaged over time and AECOM recommends that existing wells MW-97-1S, MW-98-9D and MW-05-14S be repaired if possible. Wells MW-97-1S and MW-98-9D are located in the southwest corner of OU-1 adjacent to the loading dock in the shared driveway between 159 Hanse Avenue and 191 Hanse Avenue. The asphalt driveway has degraded over time. The concrete well pads have crumbled, and the wells have filled with debris. MW-05-14S is located on the west side of Hanse Avenue, across from the Columbia Cement loading dock. The steel well cover was damaged and the well filled with sediment. NYSDEC has requested that these wells be repaired or replaced. Well MW-97-3S is located at the northeast corner of OU-1. The well is near the shared boundary between 159 Hanse Avenue and 143 Hanse Avenue. The occupant of 143 Hanse Avenue, Gershow Recycling (Gershow) has extended their fencing close to the well location. The well was covered during this expansion and has not been sampled since 2010. NYSDEC has requested that MW-97-3S be located, repaired, or replaced so that it can be sampled. AECOM recently located MW-97-3S beneath debris and it is in good condition.

Debris will be removed from the well(s) and new concrete pads, protective covers and locking caps will be placed on the wells. The wells will be re-developed until free of sediment. If the well(s) cannot be repaired, the existing well will be abandoned in accordance with NYSDEC requirements. Any abandoned well will be replaced by a well of similar construction in a location as close to the abandoned well as possible. Wells will be installed using hollow stem augers. Soil cuttings will be contained in 55-gallon drums and stored at the former Columbia Cement building pending subsequent off-site disposal after prior approval from NYSDEC. The replacement well(s) will be constructed of 2-inch inner diameter (ID), Schedule 40 PVC screen and riser pipe with a threaded bottom cap. The screens will be 10 feet in length with No. 10 (0.010 inch) slot. In each well a sand pack will be placed in the annular space from the bottom of the well to 1 foot above the top of the well screen. A bentonite seal will be placed above the sand pack. The seal will be at least 2 feet thick. A cement-bentonite grout will be placed from the top of the bentonite seal to approximately 3 feet below grade. Each well will be finished with a flush-mount steel cover set in concrete, and a water-tight locking cap. Wells will be installed with the same screen interval as the well it replaced. After repair or replacement, the wells will be surveyed by a New York-licensed surveyor. The well coordinates will be surveyed in New York State Plane Coordinates. The elevation of the ground surface and the top of the PVC casing will be surveyed to the nearest 0.01 feet.

Based on recent site reconnaissance with a drilling contractor in April 2021, wells MW-97-1S and MW-98-9D cannot be repaired/replaced at this time while the driveway is in its current degraded condition. Without cohesive pavement surrounding the well pads, any repaired or replaced wells will likely be damaged again in a short time by the frequent truck traffic. There are also numerous subsurface utilities in that area of the driveway, including water, gas, and sewer lines, leaving limited room for new wells. The repair/replacement of MW-97-1S and MW-98-9D will need to be delayed until the driveway is repaved. In the interim, AECOM recommends that samples be collected from wells OW-1 and OW-2 in the adjacent loading dock. Wells OW-1 and OW-2 have the same screen intervals as MW-97-1S and MW-98-9D, respectively, and are proposed for use to collect representative samples until the monitoring wells are repaired.

Monitoring Well Installation

To assess deeper groundwater conditions in the northeast portion of the Site, a deep well will be installed near shallow well MW-97-3S. The well location will be cleared using either a hand auger or other non-mechanical means to a depth of 5 feet. Continuous soil samples will be collected from 5 feet below grade to the end of the boring. The boring will be terminated at the lower confining clay layer (approximately 35 feet below grade). Soils will be screened with a calibrated photoionization detector (PID) and the lithology

will be logged. Soil cuttings will be contained in 55-gallon drums and stored at the former Columbia Cement building pending subsequent off-site disposal.

The well will be constructed of 2-inch ID, Schedule 40 PVC screen and riser pipe with a threaded bottom cap. The screen will be 10 feet in length with No. 10 (0.010 inch) slot. The well will be screened across the 10-foot interval immediately above the lower confining clay layer (approximately 25 to 35 feet below grade). A sand pack will be placed in the annular space from the bottom of the well to 1 foot above the top of the well screen. A bentonite seal will be placed above the sand pack. The seal will be at least 2 feet thick. A cement-bentonite grout will be placed from the top of the bentonite seal to approximately 3 feet below grade. The well will be finished with a flush-mount steel cover set in concrete, and a water-tight locking cap.

After installation, the well will be surveyed by a New York-licensed surveyor. The well coordinates will be surveyed in New York State Plane Coordinates. The elevation of the ground surface and the top of the PVC casing will be surveyed to the nearest 0.01 feet.

Groundwater Level Monitoring

To evaluate groundwater flow direction(s), groundwater level monitoring will be performed. Since water levels in the Site vicinity are tidally influenced, monitoring will be done over multiple tidal cycles. Micro-Diver® pressure transducer/dataloggers (Van Essen) will be installed in the following monitoring wells: MW-1S, MW-1D-97, MW-98-8S, MW-98-8D, MW-97-3S, new well MW-21-3D, MW-97-4S, MW-00-12D, MW-97-1S, MW-98-9D, MW-97-2S, MW-98-10D, MW-05-14S, MW-05-15D, MW-09-24S, MW-09-25D, MW-17-28S and MW-17-29D. If wells MW-97-1S and MW-98-9D are not repaired/ replaced prior to the groundwater level monitoring, wells OW-1 and OW-2 will be utilized as replacements since they have already been previously surveyed for elevation and are suitable for use in assessing groundwater elevation in the area. The wells in which groundwater level monitoring will be performed are shown in Table 1. One Micro-Diver® will also be installed in Freeport Creek behind 146 Hanse Avenue to record surface water levels. The Micro-Divers® will be programmed to record water levels every 15 minutes. Water levels will be monitored for a period of at least 26 hours so that at least two complete tidal cycles are included in the monitoring period. One Baro-Diver® will be run for the same period to record barometric pressure so that any necessary barometric pressure corrections can be made. The groundwater level monitoring will not be performed during a period with significant precipitation during or within the preceding 24 hours.

Groundwater Sampling

At least 7 days after completion of well repair/replacement and installation, groundwater samples will be collected from selected wells. The wells to be sampled are presented in Table 1.

The groundwater sample from each well will be analyzed for the following parameters:

- Volatile organic compounds (VOCs) by EPA Method 8260C;
- 1,4-dioxane by EPA Method 8270 Selective Ion Monitoring (SIM); and,
- 21 PFAS compounds listed in Appendix G of the NYSDEC PFAS Guidance Document by EPA Method 537.1 Modified (low level).

VOC analysis is being performed to obtain up-to-date groundwater VOC levels. In addition, 1,4-dioxane and PFAS are being analyzed because they were only analyzed for once in 2017. An additional data set will give an indication of either increasing or decreasing concentration trends. To the extent possible, the sampling will be timed to coincide with the semi-annual OU-2 groundwater monitoring event tentatively scheduled for August 2021.

The samples will be collected by personnel trained to perform PFAS sampling. Since PFAS are to be analyzed, the following techniques will be used in conjunction with, or instead of, the normal Site sampling methods:

- Use only laboratory certified "PFAS-free" water for equipment decontamination.
- Use only Alconox® or Liquinox® soap for decontamination.
- No Sharpies will be used, only ball point pens.
- No waterproof field books/ laboratory notebooks, only loose paper on aluminum clipboards.
- Do not wear the following:
  - Personal hygiene items (cosmetics, lotions, moisturizers).
  - Sunscreens and insect repellants. Instead, wear long sleeve / light colored 100% cotton shirts and wide brimmed hats.
  - New or unwashed clothing.
  - Clothing washed with fabric softeners.
  - Treated clothing (i.e., waterproof, water resistant, stain-resistant, etc.).
  - Treated boots (i.e., waterproof, water resistant, stain-resistant, etc.).
  - Coated Tyvek® suits.
- Do not handle prepackaged food products immediately prior to sampling.
- Wear a new pair of disposable powderless nitrile gloves prior to sample collection.
- Do not use fluoropolymer bailers, pump bladders, tubing, valves, and other pump parts.
- Do not use anything with Teflon®.
- Use HDPE and silicon materials only.
- Do not use glass containers for sampling. Use only bottleware provided by the laboratory (i.e., polypropylene or HDPE sample bottles with unlined [no Teflon®] polypropylene or HDPE screw caps).
- Do not use aluminum foil.
- Do not filter samples in the field.

Samples will be delivered to Eurofins-Lancaster Laboratories, Inc. of Lancaster, Pennsylvania a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program-(ELAP) approved analytical laboratory. Standard laboratory turn-around time [10 business days] will be requested.

Purged groundwater will be transferred to appropriate on-site containers for appropriate characterization and disposal.

Waste Disposal

Soil cuttings generated during drilling will be placed in 55-gallon drums, labeled as non-hazardous waste, and staged on-Site for subsequent disposal at a licensed facility. The soil will be characterized as required by the disposal facility. After facility acceptance and approval by NYSDEC, the soil will be removed from the Site for disposal.

Well development and purge water will be placed in 55-gallon drums, labeled as non-hazardous waste, and staged on-Site for subsequent disposal at a licensed facility. The water will be characterized as required by the disposal facility. After facility acceptance and approval by NYSDEC, the water will be removed from the Site for disposal.

Health and Safety

All work will be performed in accordance with AECOM's site-specific Health and Safety Plan. During all ground-intrusive activities, air monitoring will be performed in accordance with the NYSDEC-approved Community Air Monitoring Plan (CAMP). The CAMP is presented in Appendix A and presents a plan for

monitoring the downwind perimeter of the work area for VOC and particulates to assure that Site work does not impact the surrounding community.

Quality Assurance

The contracted laboratory has stated that they can achieve a method detection limit of 2 ng/l for each PFAS target analytes provided in the table below:

	Chemical Name	Abbreviation	CAS Number
1	Perfluorobutanesulfonic acid	PFBS	375-73-5
2	Perfluorohexanesulfonic acid	PFHxS	355-46-4
3	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
4	Perfluorooctanesulfonic acid	PFOS	1763-23-1
5	Perfluorodecanesulfonic acid	PFDS	335-77-3
6	Perfluorobutanoic acid	PFBA	375-22-4
7	Perfluoropentanoic acid	PFPeA	2706-90-3
8	Perfluorohexanoic acid	PFHxA	307-24-4
9	Perfluoroheptanoic acid	PFHpA	375-85-9
10	Perfluorooctanoic acid	PFOA	335-67-1
11	Perfluorononanoic acid	PFNA	375-95-1
12	Perfluorodecanoic acid	PFDA	335-76-2
13	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
14	Perfluorododecanoic acid	PFDoA	307-55-1
15	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
16	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
17	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
18	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
19	Perfluorooctanesulfonamide	FOSA	754-91-6
20	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
21	N-ethyl perlfuorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Additionally, the contracted laboratory has indicated that they can achieve a method detection limit of 0.28 µg/L for 1,4-dioxane.

One field duplicate, one equipment blank, and one matrix spike/matrix spike duplicate sample will be collected for every 20 samples. Equipment blanks will be collected with PFAS free water supplied by the laboratory. A summary of the QA/QC samples is shown on Table 1. The laboratory will provide the results in an Analytical Services Protocol (ASP) Category B equivalent data deliverable. A Data Usability Summary Report (DUSR) will be performed for all data acquired and included with the groundwater sampling summary report. All data from this sampling event will be uploaded to the NYSDEC EQuIS database.

Schedule

AECOM will initiate the field program when NYSDEC approves this Work Plan and upon obtaining an access agreement with the new property owner. The monitoring well repair/replacement/installation activities will occur first. Groundwater level monitoring and monitoring well sampling will take place at least one week after well development / redevelopment. NYSDEC will be provided at least seven-day advance notice of the planned sampling date.

Reporting

The results of this Emerging Contaminants Monitoring will be provided to NYSDEC as a stand-alone summary letter report upon the completion of groundwater sampling and data assessment activities. The report will include an assessment of current contaminant concentrations and any notable changes since the 2017 sampling. The report will include recommendations for any additional investigation that may be needed to further assess contaminant sources and/or receptors. The letter report will be submitted to NYSDEC within 45 days of receipt of laboratory data.

If you have any questions or comments, please contact me at (973) 883-8500.

Sincerely yours,

AECOM Technical Services, Inc.

Mark Becker, PG
Columbia Cement Task Leader
mark.becker@aecom.com

Attachments:
Table 1
Figures 1 and 2
Appendix A – Community Air Monitoring Plan

cc: Mr. Daniel Tucholski, NYSDOH, Albany

TABLES

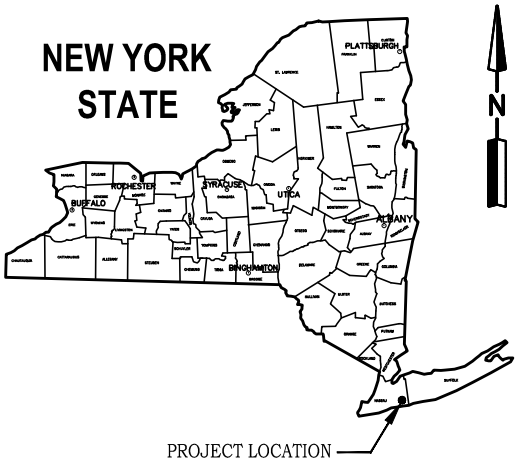
TABLE 1
EMERGING CONTAMINANT MONITORING PROGRAM
COLUMBIA CEMENT COMPANY SITE
FREEPORT, NEW YORK

OPERABLE UNIT	WELL ID	2017 PFAS and 1,4-D SAMPLING RESULT			DECEMBER 2020 VOC SAMPLING RESULT			WELLS TO BE USED FOR WATER LEVEL MONITORING	WELLS TO BE SAMPLED	COMMENT
		PFOA ng/l	PFOS ng/l	1,4-D µg/l	1,1,1-TCA µg/l	1,1-DCA µg/l	CA µg/l			
OU-1	MW-1S	**880**	**450**	**2**	0.56 J	0.97 J	< 1.0	X	X	
	MW-1D-97	**1,900**	**750**	**6**	1.0 UJ	4.2 J	1.0 U	X	X	
	IP1-4D	**350**	**150**	**2.2**	**32**	**19**	**260**			
	IP1-7I	**370**	**180**	**1.3**	**38**	**27**	**340**			
	IP1-8D	**370**	**110**	**2.7**	1.0 U	0.25 J	**71**			
	IP2-8	**2,300**	**600**	**6**	1.0 U	0.93 J	**9.4**		X	Highest 2017 PFOA concentration.
	IP3-2	**170**	**120**	**16**	1.3	**23**	**160**			
	IP4-6	**500**	**200**	**1.3**	1.0 U	1.0 U	**71**			
	MW-98-8S	**1,600**	**700**	**26**	1.0 U	1.0 U	0.23 J	X	X	Upgradient boundary.
	MW-98-8D	**1,900**	**1,300**	**9**	1.0 U	0.46 J	1.0 U	X	X	Upgradient boundary, Highest 2017 PFOS.
	MW-97-3S	N/A	N/A	N/A	N/A	N/A	N/A	X	X	Well located.
	MW-21-3D	N/A	N/A	N/A	N/A	N/A	N/A	X	X	To be installed near MW-97-3S
	MW-97-4S	**370**	**170**	**11**	1.0 U	1.0 U	**6.2**	X	X	
	MW-00-12D	**720**	**360**	**4**	1.0 U	0.6 J	1.0 U	X	X	
	MW-97-6S	**52**	**110**	**60**	1.0 U	1.0 U	**28**			
	MW-97-1S	**20**	**44**	**14**	NS	NS	NS	X	X	Well damaged, to be replaced.
	MW-98-9D	**150**	**260**	**69**	NS	NS	NS	X	X	Well damaged, to be replaced.
	OW-1	N/A	N/A	N/A	1.0 U	1.0 U	3.7	X*	X*	*To be used if MW-97-1S is not accessible
	OW-2	N/A	N/A	N/A	1.0 U	1.0 U	**200**	X*	X*	*To be used if MW-98-9D is not accessible
	OW-3	**44**	**38**	**7.7**	1.0 U	1.0 U	1.0 U		X	
	OW-4	**290**	**390**	**18**	1.0 U	1.3	1.0 U		X	
	MW-97-2S	**260**	**200**	**4.5**	1.0 U	1.0 U	1.0 U	X	X	
	MW-98-10D	**220**	**190**	**6.9**	1.0 U	1.0 U	1.0 U	X	X	
OU-2	MW-03-13S	**23**	**36**	0.24	NS	NS	NS			
	MW-05-14S	1.7	2.0 U	**29**	NS	NS	NS	X	X	Well damaged, to be repaired.
	MW-05-15D	9	2.4	**9.5**	1.0 U	1.0 U	0.23	X	X	
	MW-09-18S	**53**	**33**	**3.4**	1.0 U	1.0 U	2.4			
	MW-09-19D	**210**	**200**	**7.6**	1.0 U	1.0 U	1.3			
	MW-09-20S	8.8	7.1	2.0 U	1.0 U	1.0 U	1.0 U			
	MW-09-21D	**78**	**72**	**6.8**	NS	NS	NS			
	MW-09-22S	**28**	**45**	**1.6**	NS	NS	NS			
	MW-09-23D	**19**	**17**	**2.6**	NS	NS	NS			
	MW-09-24S	2.4	2.0 U	2.0 U	1.0 U	1.0 U	1.0 U	X	X	
	MW-09-25D	**120**	44	**12**	1.0 U	1.0 U	**110**	X	X	
	MW-09-26D	**40**	**36**	0.47	1.0 U	1.0 U	0.65 J			
	MW-17-27S	8.3	**16**	**2.37**	10 U	10 U	10 U			
	MW-09-28S	**77**	**55**	**9**	NS	NS	NS	X	X	
	MW-09-29D	2.8	5.2	**1.3**	NS	NS	NS	X	X	
		SUBTOTAL						18	21	
QA/QC Samples		Field Duplicates							2	
		Matrix Spike (MS)							2	
		Matrix Spike Duplicate (MSD)							2	
		Equipment Blanks							3	
		SUBTOTAL							9	
		TOTAL							30	

Notes

PFOA : Perfluorooctanoic acid
PFOS : Perfluorooctanesulfonic acid
1,4-D : 1,4-Dioxane
1,1,1-TCA : 1,1,1-trichloroethane
1,1-DCA : 1,1-dichloroethane
CA : chloroethane
ng/l : nannograms per liter
µg/l : micrograms per liter
U : Not detected at stated reporting limit.
NS : Not Sampled
N/A : Not applicable
BOLD : Concentration exceeds applicable NYSDEC criteria.

FIGURES



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SCALE IN FEET

REFERENCE:
U.S.G.S. 7.5 MINUTE QUADRANGLE:
FREEPORT, NY (2010)

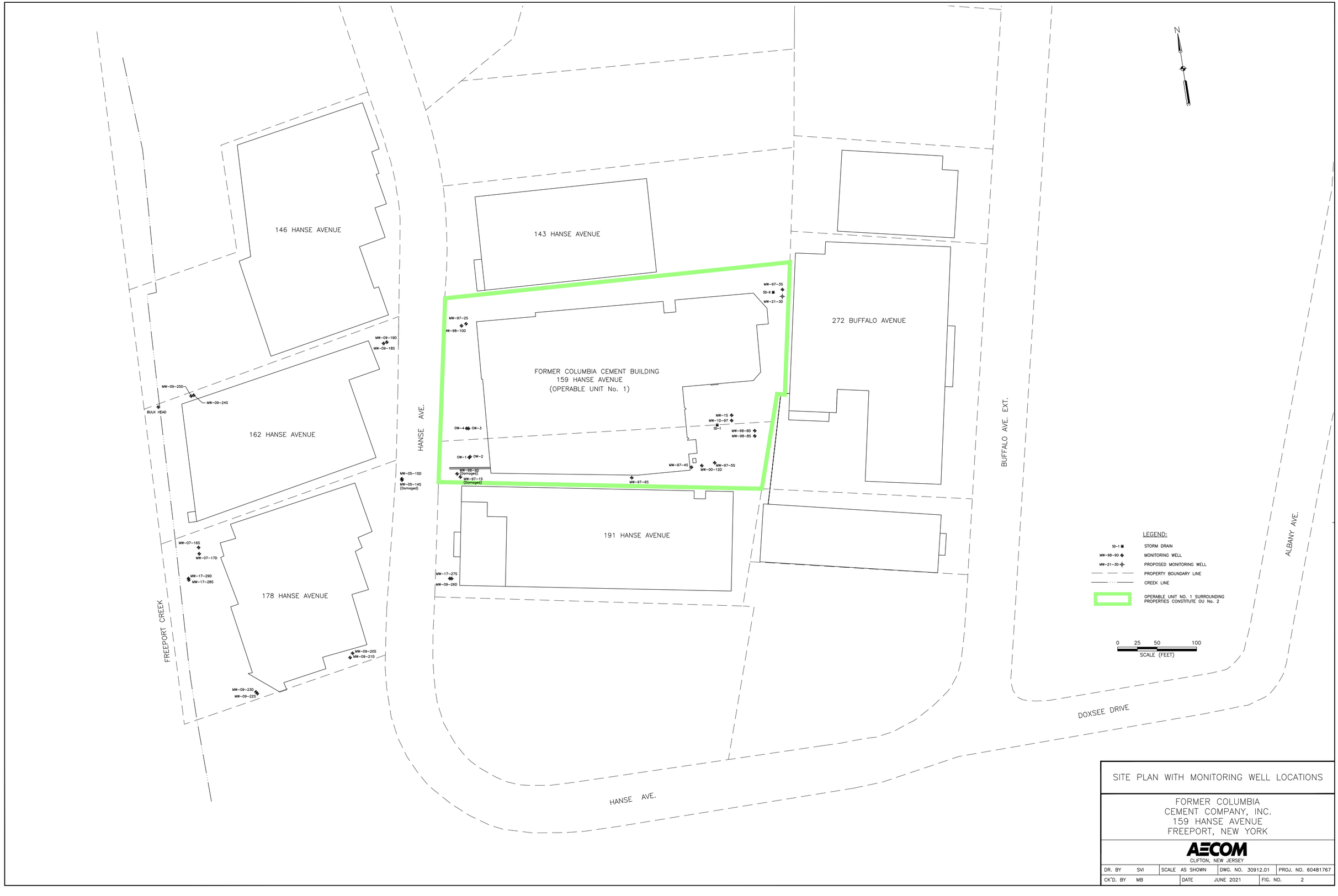
SITE LOCATION MAP
FORMER COLUMBIA CEMENT COMPANY, INC.
SITE NO. 130052
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
1255 Broad Street
Clifton, New Jersey 07013
PHONE: (973) 883-8500
FAX: (973) 883-8501

DATE: 01/23/15
JOB: 11130912

FIGURE 1

K:\Cadd\Columbia Cement\Columbia Cement-Unit No.2\11130912(Unit.No.2)\30912.01-FIG.1.dwg, 5/5/2016 9:22:57 AM



SITE PLAN WITH MONITORING WELL LOCATIONS

FORMER COLUMBIA
CEMENT COMPANY, INC.
159 HANSE AVENUE
FREEPORT, NEW YORK

AECOM
CLIFTON, NEW JERSEY

DR. BY	SVI	SCALE	AS SHOWN	DWG. NO. 30912.01	PROJ. NO. 60481767
CK'D. BY	MB	DATE	JUNE 2021	FIG. NO.	2

APPENDIX A
COMMUNITY AIR MONITORING PLAN

COMMUNITY AIR MONITORING PLAN

OPERABLE UNIT NO. 1

FORMER COLUMBIA CEMENT COMPANY SITE

FREEPORT, NEW YORK

SITE NUMBER 130052

Prepared for:
BP UK Retained Holdings
201 Helios Way
Helios Plaza 6.370A
Houston, Texas 77079

Prepared by:
AECOM
1255 Broad Street
Suite 201
Clifton, New Jersey 07013

1.0 INTRODUCTION

The Former Columbia Cement Company (CCC) Site located at 159 Hanse Avenue (Site) has undergone extensive environmental investigation in response to a 1988 release of 1,1,1-trichloroethane (TCA). A supplementary Remedial Investigation Report was submitted to NYSDEC in December 2006 and a Feasibility Study Report was submitted in February 2008. A Record of Decision was prepared by NYSDEC in March 2008, indicating selected remediation/mitigation measures for impacted soil, groundwater, and soil vapor. The remediation/mitigation measures commenced in 2008. AECOM (formerly URS Corporation) has prepared this Community Air Monitoring Plan (CAMP) to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air. Protection of Site workers will be addressed through a site-specific Health and Safety Plan (HASP).

2.0 BACKGROUND

The site building was constructed in 1969 on the location of a former municipal landfill. From 1969 to 1996, Columbia Cement produced adhesives in the Site building, including solvent-base adhesives. Multiple above-ground and underground storage tanks were present at the Site containing solvents, raw materials and other materials. In 1988, a tanker truck offloading material ruptured and approximately 1,760 gallons of TCA was spilled to the ground surface and flowed to a storm drain in the UST area. Since then the Site has undergone numerous investigations, documented in other submittals. In December 2003 Delaware Engineering submitted a Remedial Investigation Report. URS Corporation submitted a Supplemental Remedial Investigation Report in December 2006. The remedial investigation activities revealed that the soil and groundwater at the Site are impacted with 1,1,1-TCA, its degradation daughter products, other solvents utilized in adhesive manufacturing and stored on Site, as well as other constituents likely related to the former municipal landfill. These soil and groundwater impacts have also created soil vapor contamination.

In January 2007, URS submitted a draft Feasibility Study Report, evaluating potential remedial alternatives. NYSDEC and NYSDOH requested further off-site investigation. When groundwater contamination of spill-related compounds was detected near Freeport Creek, NYSDEC divided the Site into two Operable Units. Operable Unit 1 (OU-1) is the onsite project area and includes the former CCC property, currently owned by Freeport 159, LLC. OU-2 is the

offsite area including downgradient properties located between Hanse Avenue and Freeport Creek and areas immediately surrounding OU-1. The Final Revised FS addressing OU-1 was submitted to NYSDEC on February 18, 2008. NYSDEC prepared the Proposed Remedial Action Plan (PRAP) in February 2008 based on this FS and selected in-situ chemical oxidation (ISCO), in-situ bioremediation and sub-slab depressurization alternatives to address soil, groundwater and soil vapor impacts, respectively, at the Site within OU-1. All of these measures involve ground-intrusive activities that could result in the release of subsurface contaminants to the atmosphere. The Record of Decision (ROD) for the OU-1 selecting the above remedies was issued by NYSDEC in March 2008. Since 2008, multiple rounds of ISCO injections have been conducted at the site.

3.0 COMMUNITY AIR MONITORING PLAN

This Community Air Monitoring Plan was prepared to present a description of air monitoring activities to be performed during ground-intrusive activities at the Site. Other Site activities will be addressed under separate CAMPs.

3.1 GROUND-INTRUSIVE ACTIVITIES

Ground intrusive activities include, but are not limited to, the installation of soil borings or monitoring wells. During ground intrusive activities, real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be necessary. Continuous monitoring will be required for all ground intrusive activities.

3.2 NON-INJECTION ACTIVITIES

Periodic monitoring for VOCs will be required during non-injection activities such as the collection of groundwater samples from existing monitoring wells or management of drums of waste. "Periodic" monitoring during sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or drum, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location.

3.3 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

During ground-intrusive activities, volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Wind direction will be determined by observing a wind direction indicator suspended near the work zone. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions, and/or if the work

location changes. Wind direction and the location of upwind and downwind monitoring locations will be recorded on a map during each day of ground-intrusive activities. The monitoring work will be performed using equipment appropriate to measure the contaminants known or suspected to be present (a PID with an 11.7 eV lamp). The equipment will be calibrated at least daily. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. Calibration information will be recorded in a CAMP Log Book.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued, and NYSDEC and NYSDOH project managers will be notified. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. The NYSDEC and NYSDOH project managers will be notified. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shut down and the Nassau County Department of Health and NYSDEC will be notified.

All 15-minute readings will be logged by the instrument, downloaded to a computer daily and be available for State (DEC and DOH) personnel and local (county or municipal) health departments to review. Instantaneous readings, if any, used for decision purposes will be recorded in a CAMP Log Book.

3.6 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate monitoring will be performed during any ground-intrusive activities, such as drilling. Particulate concentrations will be monitored at the start of the day and periodically at the upwind perimeter of the exclusion zone. Particulate concentrations will be monitored continuously at the downwind perimeters of the exclusion zone at a temporary particulate monitoring station. The

particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. In addition, fugitive dust migration will be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed and the NYSDEC and NYSDOH project managers will be notified. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work will be stopped and a re-evaluation of activities initiated. The NYSDEC and NYSDOH project managers will be notified. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be logged by the instrument, downloaded to a computer daily and be available for State (DEC and DOH) personnel and local (county or municipal) health departments to review.

3.7 NUISANCE ODOR MONITORING, RESPONSE LEVELS, AND ACTIONS

Periodic monitoring of nuisance odors will be conducted at the downwind perimeter of the exclusion zone by smelling the ambient air. If nuisance odors are detected the work area will be checked to evaluate whether the odors are emanating from the source area. Other businesses in the area may produce nuisance odors. If the origin of the nuisance odors is determined to be the work area, work will be stopped and a re-evaluation of activities initiated. Hydrogen sulfide has a distinctive odor, but those who smell it are quickly subject to olfactory fatigue. If site-related nuisance odors (i.e. VOCs and/or hydrogen sulfide) are noted, monitoring with a PID and/or multi-gas meter will be conducted at that location until readings return to background levels.

Attachment G

Client-Specific Requirements/Documents

bp

Updated in 2015

The Golden Rules of Safety cover the following activities:

- **Permit to work**
- **Ground disturbance**
- **Confined space entry**
- **Working at heights**
- **Energy isolation**
- **Lifting operations**
- **Driving safety**
- **Hot work**

Updated in 2015

The Golden Rules provide practical support in the application of BP's Operating Management System (OMS). They are aimed at field personnel - employees or contractors working at BP-operated sites who carry out, or are responsible for, eight activities with particular potential to cause serious injuries or incidents, especially fatalities.

The Golden Rules handbook is for use at the worksite to remind everyone of some key BP requirements intended to keep people safe at our sites. They must be followed and can help field personnel to:

- Perform better risk assessments
- Confirm barriers and controls are in place before work starts
- Facilitate safety inspections and leadership worksite visits

The eight Golden Rules are aligned with OMS and support delivery of its requirements. Refer to **OMS** 3.2.1, 3.4.5, 3.7, 4.5.1 and GDP 4.5-0001 for more information.

Updated in 2015

For all 8 Golden Rule activities, remember…

- All of us who work for, or on behalf of, BP are responsible for our safety and the safety of those around us.
- Do not conduct work without a pre-job risk assessment and a safety discussion appropriate for the level of risk.
- Only undertake work for which you are trained, competent, medically fit and sufficiently rested and alert.
- Use engineering controls, work practices and personal protective equipment as per the risk assessment and site requirements.
- Check that there is an emergency response plan before starting work.
- Promptly report safety incidents or near misses to the appropriate BP contact.
- If there is a change to planned work, stop the work until the change is resolved through a management of change process and approved by the relevant authority.
- Every member of the workforce has the obligation and authority to stop unsafe work.

Updated in 2015

Permit to work

Before conducting work that involves confined space entry, work on energy systems, ground disturbance, hot work, or other potentially hazardous tasks, a permit must be obtained that:

- Defines the scope of the work, its location, and when the permit expires.
- Identifies the hazards and risk associated with the work.
- Establishes control measures to eliminate or reduce the risk.
- Identifies energy sources that need to be isolated.
- Requires that isolations are not removed before all related permits have been signed off as complete.

See next page

Updated in 2015

Permit to work

Continued...

- Links the work to other associated work permits or simultaneous operations (SIMOPS).
- Only authorizes work that is defined in the task description.
- Describes adequate control for the return to normal operations.
- Communicates the above information to all involved in the work.
- Is issued following a pre-job worksite inspection to confirm the required control measures are in place, that site conditions have not changed and any new potential hazards have been risk assessed and managed.
- Is authorized, monitored, and re-validated by a responsible person.

Updated in 2015

Ground disturbance

Work that involves a man-made cut, cavity, trench, or depression in the earth's surface formed by earth removal must not proceed unless:

- A hazard assessment of the work site is completed by the competent person(s).
- All underground hazards, i.e., pipelines, electric cables, etc., have been identified, located and, if necessary, isolated.
- A confined space entry permit is issued when the ground disturbance meets the definition of a confined space.
- Ground movement is controlled and collapse prevented by shoring, sloping, benching, etc., as appropriate.

See next page

Updated in 2015

Ground disturbance

Continued...

- A plan is in place to control access to the worksite.
- There is a plan for timely extraction & rescue of personnel.
- Inspections are completed after man-made or natural events, such as heavy rainfall.
- Ground and environmental conditions are continuously monitored for change.

Updated in 2015

Confined space entry

Entry in any confined space must not proceed unless:

- There are no practicable alternatives to entry.
- All sources of energy affecting the space are isolated.
- The confined space atmosphere is tested, verified safe for occupancy, and repeated as often as defined by the permit.
- The hazards, risks and controls in the confined space entry permit are communicated to all affected personnel.

See next page

Updated in 2015

Confined space entry

Continued...

- A stand-by person is stationed at the entry point and maintains communication with entrants during the time the occupants are inside the confined space.
- A plan for timely rescue of workers is in place.
- A confined space entry permit is issued.
- Unauthorized entry is prevented.

Updated in 2015

Working at heights

Working at heights of 2 metres (6 feet) or higher above the ground without a fixed platform that has guard rails or handrails must not proceed unless:

- A properly anchored fall arrest system is used.
- The fall arrest system ensures 100% tie-off is achieved at all times.
- A plan is in place for the timely rescue of personnel performing work at height while using fall arrest equipment.
- Fall arrest equipment is inspected prior to each use.
- The risk of dropped objects on personnel and equipment below has been assessed and plans to manage the risks established.

Updated in 2015

Energy isolation

Any isolation of energy systems; mechanical, electrical, process, hydraulic and others, must ensure that:

- There is an approved method to:
  - isolate equipment
  - discharge stored energy
  - reinstate equipment
- Isolation points are locked and tagged.
- A test is conducted before any related work begins to confirm the isolation is effective.
- There is a process to communicate the status of isolations between:
  - shifts
  - different workgroups
- The isolation is periodically monitored for effectiveness.

Updated in 2015

Lifting operations

Lifts utilizing cranes, hoists, or other mechanical lifting devices must not proceed unless:

- A competent person(s) has completed an assessment of the lift, and determined the appropriate lift method and equipment.
- Anyone involved in a lifting operation, including for rigging, is competent for the specific job and/or equipment on which they are working.
- Lifting devices and equipment have been certified for use to local legal or regulatory requirements.
- The load is less than the dynamic and/or static capacities of the lifting equipment.

See next page

Updated in 2015

Lifting operations

Continued...

- All safety devices installed on lifting equipment are operational.
- All lifting devices and equipment have been visually examined before each lift by a competent person(s).
- Clear lines of communication during a lift have been established.
- An exclusion zone has been established to limit access to all workers except essential personnel.
- External conditions which could affect the lift are monitored (e.g., ground condition, wind, etc.).

Updated in 2015

Driving safety

All categories of vehicle, including self-propelled mobile plant, must not be operated unless:

- Vehicle is equipped with the required safety features and is maintained in safe working order.
- Number of passengers does not exceed manufacturer's specification and legal limits for the vehicle.
- Loads are secure and do not exceed manufacturer's specification and legal limits for the vehicle.
- A documented risk assessment is completed before motorcycles are allowed for use on BP business.

See next page

Updated in 2015

Driving safety

Continued...

Drivers must not operate the vehicle unless:

- They and all occupants wear seat belts whenever the vehicle is moving.
- They have a valid driving license for the class of vehicle being operated and to drive in that country, have been appropriately trained and assessed, and are medically fit to operate the vehicle.
- They are rested and alert and do not operate any vehicle when fatigued.
- They are not under the influence of alcohol or drugs, or their fitness to drive impaired by medication or other substance.
- They do not use a mobile phone or other two-way communication device while operating the vehicle.
- The risks of the journey have been assessed and a journey management plan is in place when driving in higher risk countries.

Updated in 2015

Hot work

Hot work must not proceed unless:

- All potential flammable and combustible materials have been isolated, removed and/or protected from the sources of ignition.
- An authorized person tests the atmosphere prior to the start of the work and during work as often as the permit requires.
- Levels of oxygen and flammable substances are kept within acceptable ranges or additional barriers applied.
- Emergency response plans are in place as appropriate given the job's risk assessment and any appropriate site requirements.

Updated in 2015

Every member of the workforce has the obligation and authority to stop unsafe work

For further information visit
the S&OR intranet

Golden Rules. Updated in 2015

APPENDIX C
DRILLING SUBCONTRACTOR HEALTH AND SAFETY PLAN

Subcontractor Environmental Health and Safety Plan (EHASP)

Prepared For:
AECOM
1255 Broad St, Suite 201
Clifton, New Jersey 07013

Project Name and Location:
Columbia Cement Company
159 Hanse Ave, Freeport NY

ADT Project Manager:
John Diamond, 516-606-6026, jdiamond@cascade-env.com

ADT EHS Contact/Qualified Person:
John Diamond, 516-606-6026, jdiamond@cascade-env.com

Prepared By:

Aquifer Drilling & Testing, Inc.
75 East 2nd Street
Mineola, New York 11501
516-616-6026

1. Responsibility/Identification of Key Line Personnel

Contractor:	Aquifer Drilling and Testing, Inc.	
Address:	75 East 2nd Street Mineola, New York 11501	
Telephone:	(516) 616-6026	Fax: (516) 616-6194

Company Executive responsible for project: William A. Poupis, wpoupis@aquiferdrilling.com	Contact No. Office: (516) 616-6026
Manager/Superintendent: Shawn Miller, smiller@aquiferdrilling.com	Contact No. Office: (516) 616-6026
Project Site Safety Representative (SSR): John Diamond, jdiamond@cascade-env.com Competent EHS Person	Contact No. Office: (516) 616-6026
AECOM EHS Manager TBD	Contact No. Office:
AECOM Project Manager Mark Becker Mark.becker@aecom.com	Contact No. Office: (973)883-8500

These personnel have the authority and responsibility for implementing the provisions of this program for:

Project Site Location	**On-site Contact No.**
159 Hanse Ave, Freeport NY	TBD

All managers and supervisors are responsible for implementing and maintaining the EHASP in their work areas and for answering worker questions about the EHASP. A copy of this EHASP is available from each manager and supervisor.

2. Statement of Subcontractor's Safety and Health Policy

Aquifer Drilling and testing, Inc. (ADT) employees may be exposed to evident risks from hazardous conditions. ADT's policy is to minimize the possibility of work-related injury through aware and qualified supervision, health and safety training, medical monitoring and the use of appropriate personal protective equipment. ADT has established a guidance program to implement its corporate policy in a manner that protects personnel to the maximum reasonable extent.

This site-specific EHASP applies to ADT personnel and/or its representatives where operations involve actual or potential exposure to safety or health hazards. This EHASP describes emergency response procedures and actual and potential physical and chemical hazards that have been identified to ADT by others.

3. Identification of Competent/Qualified Persons

CONTACT	POSITION	Phone #
John Diamond	Project Manager/EHS Officer	516-616-6026

All training certificates and documentation to be provided prior to commencement of work.

4. Scope of Work Evaluation

The work activities that will take place are described below. For this project, there will not be any lower tier subcontractors. Lower tier subcontractor activities are not included in this section.

Major Activities of Contractor – Install 2 well couplets at 272 Buffalo Ave. Each couplet will have 1 well screened 25-35' and one well screened 10'-20'. Wells will be 2" diameter with flush mount covers. Install 1 replacement well couplets at 159 Hanse Ave in driveway. Each couplet will have 1 well screened 25-35' and one well screened 10'-20'. Wells will be 2" diameter with flush mount covers. Then abandon the old wells and remove the flush mounts.
Repair well couplet in Hanse Avenue. Shallow well needs to be rehabbed and redeveloped. New well boxes for shallow and deep wells. Install new well in northeast corner of 159 Hanse Avenue to replace inaccessible well. Replace flush mount covers on 5 additional wells. Obtain street opening permit from Freeport for well in road (cost is subject to change pending Freeport review).

Major Activities of lower tier subcontractor(s) – Not Applicable.

5. Hazard/Risk/Exposure Assessment

Major hazards or risks associated with the scope of work evaluation are listed below. For each major activity listed, a Job Safety Analysis (JSA) has been developed and is included as Attachment 2.

- Drilling and associated soil sampling;
- Decontamination of Equipment, machine and tooling.
- Hand Auger/Post Hole Digging

6. Subcontractor Periodic Safety Inspections/Audits

Periodic inspections to identify and evaluate on-going workplace hazards shall be performed by the following competent persons or observers in the following areas of our workplace:

Competent Person/Observer	Area of Expertise/Responsibility
John Diamond/Shawn Miller/Joe McGill	Field Operations

Periodic inspections are performed according to the following schedule:

- Daily;
- When we initially established our EHASP;
- When new substances, processes, procedures or equipment which present potential new hazards are introduced into our workplace;
- When new, previously unidentified hazards are recognized;
- When occupational injuries and illnesses occur;
- When we hire and/or reassign permanent or intermittent workers to processes, operations, or tasks for which a hazard evaluation has not been previously conducted; and
- Whenever workplace conditions warrant an inspection.

Periodic inspections consist of identification and evaluation of workplace hazards. All periodic inspections

7. Subcontractor Risk Mitigation Plan

Potential hazards and risk mitigation will be discussed during the daily safety meetings throughout the duration of this project. A Job Safety Analysis (JSA) for each task is attached to this EHASP.

8. Compliance Requirements Policy

Management is responsible for ensuring that all safety and health policies and procedures are clearly communicated and understood by all employees. Managers and supervisors are expected to enforce the rules fairly and uniformly.

All employees are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment.

Our system of ensuring that all workers comply with the rules and maintain a safe work environment includes:

- Informing workers of the provisions of our EHASP;
- Evaluating the safety performance of all workers;
- Recognizing employees who perform safe and healthful work practices; and
- Providing training to workers whose safety performance is deficient.

9. Written Progressive Disciplinary Program

The following forms of discipline will be implemented for employees who willfully commit an unsafe act:

- Verbal Warning: The company safety officer may give the employee a verbal warning for a known unsafe act. A second verbal warning in the same shift will be grounds for release from the current work shift without pay.
- Written Warning: A written warning will be issued automatically for a second verbal warning for an unsafe act. The written warning will become part of the employee's permanent personnel record.
- If a known unsafe act is performed by an employee after they have received a written warning, the employee will be pulled from the current job without pay pending his/her supervisor's determination of the appropriate disciplinary action which may include retraining, suspension, or immediate dismissal.

10. Hazard Correction Policy

Unsafe or unhealthy work conditions; practices or procedures shall be corrected in a timely manner based on the severity of the hazards. Hazards shall be corrected according to the following procedures:

- When observed or discovered;

- When an imminent hazard exists, which cannot be immediately abated without endangering employees or property, we will remove all exposed workers from the area except those necessary to correct the existing condition. Workers necessary to correct the hazardous condition shall be provided with the necessary protection; and
- All such actions taken and dates they are completed shall be documented on the appropriate forms.

11. Training and Instruction Policy

All workers, including managers and supervisors, shall have training and instruction on general and job-specific safety and health practices. Training and instruction shall be provided as follows:

- When the EHASP is first established;
- To all new workers;
- To all workers given new job assignments for which training has not previously provided;
- Whenever new substances, processes, procedures or equipment are introduced to the workplace and represent a new hazard;
- Whenever the employer is made aware of a new or previously unrecognized hazard;
- To supervisors to familiarize them with the safety and health hazards to which workers under their immediate direction and control may be exposed; and,
- To all workers with respect to hazards specific to each employee's job assignment.
- To all workers the BEDC EHS Orientation Training, 10 or 30 Hour Construction and NYS Dig Safe Training, if required.

Workplace safety and health practices for all locations include, but are not limited to, the following:

- Explanation of the employer's EHASP, ADT's Safety Program, emergency action plan and fire prevention plan, and measures for reporting any unsafe conditions, work practices, injuries and when additional instruction is needed.
- Use of appropriate clothing, including gloves, footwear, and personal protective equipment.
- Information about chemical hazards to which employees could be exposed and other hazard communication program information.
- Availability of toilet, hand-washing, and drinking water facilities.
- Provisions for medical services and first aid including emergency procedures.

In addition, we provide specific instructions to all workers regarding hazards unique to their job assignment, to the extent that such information was not already covered in other training.

12. Project Site Employees Orientation Program Subjects

As a condition of working on a remediation project involving the potential for exposure to hazardous substances and health hazards, our workers will receive information about the following subjects:

- Names of personnel responsible for site safety and health
- Reporting emergencies, incidents and unsafe conditions
- Emergency/evacuation plans
- Safety, health and other hazards at the site
- Review of all activities on site and related Job Safety Analyses (JSAs)
- Proper use of personal protective equipment
- Work practices by which a worker can minimize risk from hazards
- Safe use of engineering controls and equipment on site
- Acute effects of compounds at the site
- Decontamination procedures

In addition to the above-mentioned information, we also orient our employees on:

- Client safety requirements
- The employer's code of safe practices – good housekeeping
- Road and highway safety practices – flagging, traffic control
- Heavy equipment operation – cranes, excavators, articulating dump trucks, etc
- Driver safety - defensive driving, operation of pick-up trucks and ATVs
- Ladder safety
- Fire prevention
- Cleaning, repairing, servicing and adjusting equipment and machinery
- Proper use of powered tools
- Guarding of belts and pulleys, gears and sprockets, and conveyor nip points
- Machine, machine parts, and prime movers guarding
- Lockout/tag out procedures
- Materials handling.
- Chainsaw and other power tool operation.
- Unsafe weather conditions – lightning, high winds
- Mobilization/demobilization – yard operations, running lines, etc.
- Landing and loading areas - release of rigging, landing layout, moving vehicles and equipment, truck locating, loading and shipping
- Ergonomic hazards - proper lifting techniques
- Personal protective equipment
- Hazardous chemical exposures

- Hazard communication
- Physical hazards - heat and cold stress, noise, and ionizing and non-ionizing radiation
- Biological hazards – poisonous plants/vegetation, animals, blood borne pathogens, etc.

13. Employee Communication System and Policy

We recognize that open, two-way communication between management and staff on health and safety issues is essential to an injury-free, productive workplace. The following system of communication is designed to facilitate a continuous flow of safety and health information between management and staff in a form that is readily understandable and consists of one or more of the following items:

- New worker orientation including a discussion of safety and health policies and procedures.
- Review of our EHASP.
- Workplace safety and health training programs.
- Regular weekly and daily safety meetings.
- Effective communication of safety and health concerns between workers and supervisors, including translation where appropriate.
- Posted or distributed safety information.
- A system for workers to anonymously inform management about workplace hazards.
- A labor/management safety and health committee that meets regularly, prepares written records of the safety and health committee meetings, reviews results of the periodic scheduled inspections, reviews investigations of accidents and exposures and makes suggestions to management for the prevention of future incidents, reviews investigations of alleged hazardous conditions, and submits recommendations to assist in the evaluation of employee safety suggestion.

14. Recordkeeping Policy

We have taken the following steps to document implementation of our EHASP:

- Records of hazard assessment inspections, including the persons conducting the inspection, the unsafe conditions and work practices that have been identified and the action taken to correct the identified unsafe conditions and work practices, are recorded on a hazard assessment and correction form
- Documentation of safety and health training for each worker, including the worker's name or other identifier, training dates, types of training, and training providers are recorded on a worker training and instruction form.

- Other records are retained as required by contract specifications or by local, state or federal (OSHA regulations). Where regulations do not specify the length of records retention, a period of three years after project completion will be used.

15. Incident/Near-Miss Incident Investigations Policy

Procedures for investigating workplace incidents and near-miss incidents include:

- Responding to the incident scene as soon as possible;
- Reporting incidents and near-miss incidents immediately to the appropriate AECOM's point-of-contact: Mark Becker, mark.becker@aecom.com
- Interviewing injured workers and witnesses;
- Examining the workplace for factors associated with the incident/near-miss incident;
- Determining the cause of the incident/near-miss incident;
- Taking corrective action to prevent the incident/near-miss incident from reoccurring;
- Recording the findings and corrective actions taken; and
- Post-accident substance abuse testing.

16. Emergency Action Plan

EMERGENCY EQUIPMENT ON SITE

Private Telephones:	In the ADT field vehicles
Two-Way Radios:	Site personnel, where necessary
First Aid Kits:	On-site, in the ADT field vehicles
Fire Extinguisher:	On-site, in the ADT field vehicles and mobile equipment

PERSONNEL RESPONSIBILITIES DURING EMERGENCY

The Site Safety Representative (SSR) is primarily responsible for responding to and correcting emergency situations. However, during any planned, unplanned, or emergency absences of the Site Safety Representative (SSR), a delegate will act as the Site Safety Representative (SSR), such that the following responsibilities are continuously provided for:

- Take appropriate measures to protect personnel including: withdrawal from the Exclusion Zone, total evacuation and securing of the site, or upgrading or down-grading the level of protective clothing and respiratory protection;

- Ensure that appropriate federal, state, and local agencies are informed, and emergency response plans are coordinated; In the event of fire or explosion, the local Fire Department should be summoned immediately. If toxic materials are released to the air, the local authorities should be informed in order to assess the need for evacuation;

- Ensure appropriate decontamination, treatment, or testing for exposed or injured personnel;

- Determine the cause of the incident and make recommendations to prevent recurrence; and

- Ensure that all required reports have been prepared.

EMERGENCY CONTACTS AND ROUTE TO HOSPITAL

Emergency phone numbers and directions to the nearest medical facility shall be posted at conspicuous places in the Support Zone (office trailer/vehicle).

Police Department and EMS	911
Fire Department (including ambulance)	911
Gas Emergency	911
National Response Center	(800) 424-8802
Poison Control Center	(800) 962-1253
Poison Control – CT	(800) 222-1222
NYSDEC (Spills Hotline)	(800) 457-7362

The following Medical is closest to the work site: Harford HealthCare.
The address is: Mount Sinai South Nassau, 1 Health Way, Oceanside NY 11572.

A hospital evacuation route map and driving directions are provided as Attachment 3 and will be posted in the office trailer/vehicle.

17. Site Specific Medical Emergency Plan

PERSONAL INJURY

In the event of a personal injury on the job site, the Site Safety Representative (SSR) must be notified immediately and the certified first aid practitioner on-site will take control. Appropriate first aid will be administered and, if necessary, the injured individual will be sent to the designated

Medical facility. First aid should be administered while awaiting an ambulance or paramedic. No persons shall re-enter the work area until the cause of injury or symptoms is determined. If injury does not affect the performance of site personnel, operations may continue. Any person transporting an injured/exposed person to a clinic or hospital for treatment should take with them directions to the hospital and information on the chemical(s) to which they may have been exposed.

18. Hazard Communication Program

Site operation planning incorporates an analysis of the hazards involved and procedures for preventing or minimizing risk to personnel. The following summarizes the rules which must be obeyed:

- The EHASP will be made available to all personnel doing field work on site. All personnel must sign this plan, indicating they have read and understood its terms.
- All personnel will be familiar with standard operating safety procedures and additional instructions contained in the EHASP.
- All personnel going on site will be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures and communications.

The EHASP will be reviewed and evaluated on an annual basis, when changes occur to 29 and/or 40 CFR that prompt a revision, or when operational changes occur that require a revision of this document.

19. Air Monitoring

No air monitoring will be conducted at this time.

20. List of Attachments

- Attachment 1 – Training Certificates and Documentation
- Attachment 2 – Job Safety Analyses (JSAs)
- Attachment 3 – Hospital Evacuation Route Map and Driving Directions

Attachment 1

Training Certificates and Documentation

See attached documents

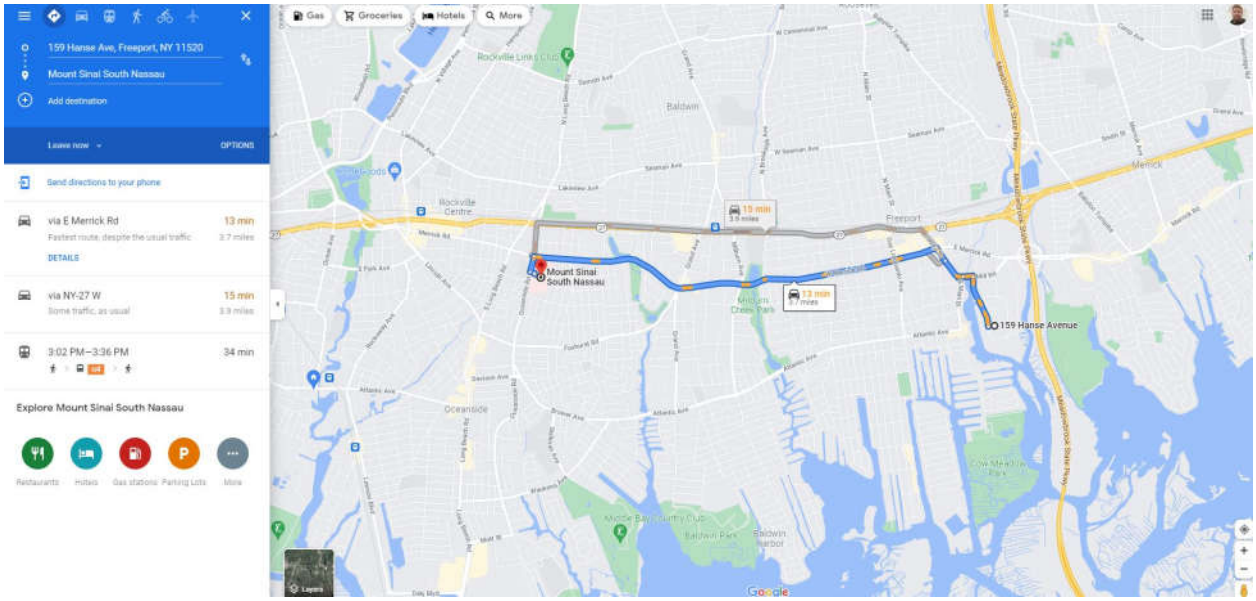
Attachment 2

Job Safety Analysis

See attached documents

Attachment 3

Hospital Route



CASCADE DRILLING | TECHNICAL SERVICES

JOB SAFETY ANALYSIS

Direct Push Operations, Track Rig & Remote Controlled

JSA Prepared By: Operations Managers, Drillers, Supervisors, EHS Dept.

JSA Approved By: EHS Department

Date: 10/12/2020

JSA Number: DP006

Site: Columbia Cement Co

Types of Hazards Anticipated:

Safety	Y	Safety	Y	Health	Y	Health	Y	Environmental	Y	Environmental	Y
Struck By (SB)	x	Fall to Below (FB)	x	Noise	x	Oxygen Deficiency		Heat Stress		Water Contaminations	
Struck Against (SA)	x	Overexertion (OE)	x	Silica		Bloodborne pathogen		Cold Stress, Ice & Snow		Ground/Soil Contamination	x
Contact By (CB)	x	Exposure (E)		Asbestos		Musculo-skeletal	x	Wind		Release to Ground	x
Contact With (CW)	x	Electric Shock (ES)		Other Dust	x	Fauna (bears, snakes, etc)		Lightning			
Caught On (CO)	x			Hazardous Chemical		Insects (ticks, bees, spiders, etc)		Visibility (Fog)			
Caught In (CI)	x			Hydrogen Sulfide		Flora (poison ivy, etc)		Soil Stability	x		
Caught Between (CBT)	x			Carbon Monoxide				Habitat destruction	x		
Fall-same level (FS)	x			Methane				Air Contamination			

Type of PPE required if marked with 'X' (must be in accordance with CDLP PPE Program requirements):

												
X	X	X	X	X	X	☐	☐	☐	☐	☐	☐	☐
Task Appropriate Gloves	Hearing Protection (min 25 dB)	ANSI Z89.1 Hard Hat	ANSI Z87.1 Safety Glasses	ASTM F2413 Steel Toe Boots, Metatarsal	ANSI High Vis Vest (or Outerwear)	Safety Goggles	Dust mask	APR	SCBA	Face shield / protective hood	Welding or Chemical protective suit	Fall protection

Other PPE Required:

Other Controls required if marked with 'X':

Engineering Controls		Administrative Controls		Environmental Controls		Permits	
Interlock		Training	x	Ventilation	x	Hot Work	
Lockout / Tag Out	x	JSA's / SJSA	x	Illumination		Utility Proximity	
Guards, Barriers	x	Warning Signs		Ground Protection	x	Confined Space	
Override		Variance				Energy Isolation	
Emergency Stops	x	MSDS (SDS)	x			Excavation	
GFCI							

Notes: Make any site specific notes on SJSA form (Doc# SF-2.4, Revised 04/30/2014). Make notes to improve JSA quality here, and turn in copy to CDLP EHS.

JSA Title:		Direct Push Operations, Track Rig & Remote Controlled					
Step No: order	**Sequence of Job Steps** Break down Job into steps.	**Potential Hazards & Impacts** Identify hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** pre action	**Procedure or action required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies	**Risk Rating** post action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**
1	Operating with remote control	Contact with - Running over your foot; Accidental movement of rig; Accidentally hitting person or fixed object	12	• When using wireless remote to move rig, stand to the left and rear if possible • Stay at least 3 feet away while moving rig • Observe the intended path of travel and use a spotter if available • Stop immediately if you lose site of the spotter • Avoid getting any closer to fixed objects than absolutely necessary • Keep people out of the line of fire • ***Always turn off remote control (to "off" position) and store in proper place prior to advancing probe rod. Engine must be restarted with key switch on control panel each time. The remote track and engine controls are only operational when the engine is started using the remote control box.***	6		
2	Operating inside buildings		8	• Ensure adequate ventilation and overhead clearance • Install secondary containment underneath the rig.	3		
3	Remove asphalt or concrete	Contact with Flying debris Cuts - Sharp objects such as concrete reinforcement materials	5	• Visual inspection • Remove mesh or rebar with cutters • Wear cut resistant gloves.	3		

4	Push Rod, collect samples	Contact with Pinch points	5	• Stay clear of moving parts • Raise pull latch to storage position • Use care handling and opening core barrel	3		
		Exposure to noise up to 115 dB		• Use “Show Your Hands” procedure. • Hearing protection must be worn (preferable plugs & muffs) • Wear nitrile gloves if there is a skin exposure potential • Upgrade to OSHA Level C if necessary (organic vapor respirator).			
		Exposure to Chemical or Hydrocarbon		• Steam clean rods between boreholes (use face shield and safety glasses) • Watch hand placement • Use correct tools for opening sleeves (macro core cutters only) • When opening sleeves, cut away from body			
		Cuts from sharp tools		• Place soil core on sturdy surface prior to cutting.			
5	Hand clear if needed	CONTACT WITH Hitting someone with hand auger	5	• Make sure work area is clear • Stay out of the line of fire • Do not exceed 50 lb. limit • Use “Safety in Motion” training	3		
		EXERTION - Back strain		• Use buddy system or mechanical advantage,			
6	Push Rod, collect samples	CONTACT WITH Pinch points	8	• Keep hand at least 6 inches from any pinch point • Watch hand placement, Stay away from moving parts • Use “Show Your Hands” procedure • Be aware of your foot placement when rig foot comes off ground • Hearing protection must be worn • Wear nitrile gloves under work gloves if there is a skin exposure potential • Upgrade to Level C if necessary (Stop Work, MOC, call Ops) • Decon equipment between hol • Wash hands before you eat or drink • Use cut resistant gloves • Use approved cutting devices • When opening sleeves, cut away from body • Place soil core on sturdy surface prior to cutting • Daily drill rig safety inspection completed and documented • Slip rings are “not” to be used under any circumstance • Use approved method for pulling rod out of hole	3		

7	Extracting stuck or tight rods	CONTACT WITH Getting struck by a bent rod when it is released	8	• If any visible bend or deviation in the rod is observed, call refusal • (Before refusal is called, discuss with client and Operation Manager.) • Do not use chains, wire cable or other non-approved pulling devices • Do not use equipment that is not designed to retrieve rod • Call Operations and to discuss options and possible drill out.	3		
		CONTACT WITH Breaking tools/ flying tooling		***Call Operations to discuss calling refusal with the direct push rig.***			

Additional Job Tasks

Step No: Order	**Sequence of Job Steps** Break Down Job Into Steps	**Potential Hazards & Impacts** Identify Hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** per Action	**Procedure or Action Required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies.	**Risk Rating** Post Action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**

EMPLOYEE NAMES:	EMPLOYEE SIGNATURES:	DATE:

CASCADE DRILLING | TECHNICAL SERVICES

JOB SAFETY ANALYSIS

Macro Core Sampling

JSA Prepared By: Operations Managers, Drillers, Supervisors, EHS Dept

JSA Approved By: EHS Department

Date: 10/12/2020

JSA Number: DP007

Site: Columbia Cement Co

Types of Hazards Anticipated:

Safety	Y	Safety	Y	Health	Y	Health	Y	Environmental	Y	Environmental	Y
Struck By (SB)	x	Fall to Below (FB)	x	Noise	x	Oxygen Deficiency		Heat Stress	x	Water Contaminations	
Struck Against (SA)	x	Overexertion (OE)	x	Silica		Bloodborne pathogen		Cold Stress, Ice & Snow	x	Ground/Soil Contamination	
Contact By (CB)	x	Exposure (E)	x	Asbestos		Musculo-skeletal	x	Wind		Release to Ground	
Contact With (CW)	x	Electric Shock (ES)		Other Dust		Fauna (bears, snakes, etc)		Lightning			
Caught On (CO)	x			Hazardous Chemical	x	Insects (ticks, bees, spiders, etc)		Visibility (Fog)			
Caught In (CI)	x			Hydrogen Sulfide		Flora (poison ivy, etc)		Soil Stability			
Caught Between (CBT)	x			Carbon Monoxide				Habitat destruction			
Fall-same level (FS)	x			Methane				Air Contamination			

Type of PPE required if marked with 'X' (must be in accordance with CDLP PPE Program requirements):

												
X	X	X	X	X	X	☐	☐	☐	☐	☐	☐	☐
Task Appropriate Gloves	Hearing Protection (min 25 dB)	ANSI Z89.1 Hard Hat	ANSI Z87.1 Safety Glasses	ASTM F2413 Steel Toe Boots, Metatarsal	ANSI High Vis Vest (or Outerwear)	Safety Goggles	Dust mask	APR	SCBA	Face shield / protective hood	Welding or Chemical protective suit	Fall protection

Other PPE Required:

Other Controls required if marked with 'X':

Engineering Controls		Administrative Controls		Environmental Controls		Permits	
Interlock		Training	x	Ventilation		Hot Work	
Lockout / Tag Out		JSA's / SJSA	x	Illumination		Utility Proximity	
Guards, Barriers	x	Warning Signs		Ground Protection		Confined Space	
Override		Variance				Energy Isolation	
Emergency Stops	x	MSDS (SDS)				Excavation	
GFCI							

Notes: Inspect all of the Macro Barrel components. Replace worn items. Be alert to sharp edges..

JSA Title:	Macro Core Sampling						
Step No: order	**Sequence of Job Steps** Break down Job into steps.	**Potential Hazards & Impacts** Identify hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** pre action	**Procedure or action required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies	**Risk Rating** post action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**
1	Assemble /Disassemble Macro core sampling tube.	Struck by wrench Muscle strain from overexertion Pin, pinch, caught in wrenches, rotation hazard.	8	• Use pipe wrench to tighten components. • Use proper lift techniques (bending at the knees and not at the waist) to lift assembly. • Stay clear of the wrench area. • Be sure the area is clear.	3		
2	Add / Remove sample liner from barrel.	Contact with machine Muscle strain from overexertion Exposure to contaminates in barrel	8	• Stay clear (1' – 2' distance) from moving machinery. • Use proper lift techniques by keeping elbows close to body while removing liner. • Known contaminates should be monitored with PID or four gas meter. • Upgrade PPE to standards in NIOSH Chemical guide book.	3		
3	Cutting sample liner tube	Hand Injury /struck by cutting tool Laceration / puncture wound from cutting tool.	8	• Liners will be placed on level surface area (i.e. a table) for opening and screening. • Use manufacture's cutting tool for opening the liners. • No fixed open blade knives. • Use type II cut resistant gloves while opening liners.	3		

Severity	Employee Injury	Environmental Damage	Property/Equipment Damage	Reputation Impact	Not Likely (Low)	Unlikely (Moderate)	Reasonably Likely	Highly Likely
	First Aid Treatment	Minor Impact on Environment	Negligible damage to Property, System or Equipment (under $1,000)	Internal Cascade Drilling LP impact only	1	2	4	7
	Requires Medical Treatment	Severe impact on environmental but easy rectified	Minor damage to Property, System or Equipment ($1,000-$5,000)	Local site impact involving Cascade Drilling LP and Cascade Drilling LP Contractors. Managed internally	3	5	8	12
	Severe injury - Fractures, Lost time injury or less than or equal to 7 days	Severe impact on environment requiring significant time to rectify	Medium level damage to Property, System or Equipment ($5,000 - $15,000)	Cascade Drilling LP Client impact on local site. Managed in coordination with Client	6	9	11	16
	Major Injury - Lost time injury more than 7 days	Major but repairable damage to the environment	Extensive Damage to Property, System or Equipment ($15,000 - $50,000)	Cascade Drilling LP Client impact on multiple sites. Incident response controlled by client. Operations closed by Client. Potential loss of Contract	10	13	17	18
	Fatality - Permanent Disability	Permanent & Irreparable Damage to Environment	Loss of major or Business critical Property, System or Equipment ($50,000 +)	National Media involved. Client impact. Loss of current Contract	14	15	19	20

Score	Risk	Action
1-5	Low Risk	Continue to Monitor and Control
6-12	Moderate	Follow Procedure & Interim Controls can be used
13-17	Significant	Stop Work as needed. Interim Controls must be used
18-20	Extreme	Stop Work and Control Hazard before work resumes

Note: Risk score between 13-20 requires a JSA or Work Instruction prior to commencement of job

Additional Job Tasks

Step No: Order	**Sequence of Job Steps** Break Down Job Into Steps	**Potential Hazards & Impacts** Identify Hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** per Action	**Procedure or Action Required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies.	**Risk Rating** Post Action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**

EMPLOYEE NAMES:	EMPLOYEE SIGNATURES:	DATE:

A signed copy of this JSA <u>MUST</u> be posted on-site and be available to any employee upon request.

JSA DEBRIEF

DATE & TIME	Participants	What Went Well	Lessons Learned

Name of Person filling out form:
Date:

CASCADE DRILLING | TECHNICAL SERVICES

JOB SAFETY ANALYSIS

Decontamination of Equipment (Pressure Washer & Steam Cleaner)

JSA Prepared By: Operations Managers, Drillers, Supervisors, EHS Dept

JSA Approved By: EHS Department.

Date: 10/12/2020

JSA Number: GEN018

Site: Columbia Cement Co

Types of Hazards Anticipated:

Safety	Y	Safety	Y	Health	Y	Health	Y	Environmental	Y	Environmental	Y
Struck By (SB)	x	Fall to Below (FB)	x	Noise		Oxygen Deficiency		Heat Stress		Water Contaminations	
Struck Against (SA)		Overexertion (OE)	x	Silica		Bloodborne pathogen		Cold Stress, Ice & Snow		Ground/Soil Contamination	
Contact By (CB)		Exposure (E)		Asbestos		Musculo-skeletal		Wind		Release to Ground	
Contact With (CW)	x	Electric Shock (ES)		Other Dust		Fauna (bears, snakes, etc)		Lightning			
Caught On (CO)				Hazardous Chemical		Insects (ticks, bees, spiders, etc)		Visibility (Fog)			
Caught In (CI)				Hydrogen Sulfide		Flora (poison ivy, etc)		Soil Stability			
Caught Between (CBT)	x			Carbon Monoxide				Habitat destruction			
Fall-same level (FS)	x			Methane				Air Contamination			

Type of PPE required if marked with 'X' (must be in accordance with CDLP PPE Program requirements):

												
X	X	X	X	X	X	☐	☐	☐	☐	X	☐	☐
Task Appropriate Gloves	Hearing Protection (min 25 dB)	ANSI Z89.1 Hard Hat	ANSI Z87.1 Safety Glasses	ASTM F2413 Steel Toe Boots, Metatarsal	ANSI High Vis Vest (or Outerwear)	Safety Goggles	Dust mask	APR	SCBA	Face shield / protective hood	Welding or Chemical protective suit	Fall protection

Other PPE Required: Faceshield required. Tyvek or other chemical protective suit may be required, consult HASP.

Other Controls required if marked with 'X':

Engineering Controls		Administrative Controls		Environmental Controls		Permits	
Interlock		Training	X	Ventilation	X	Hot Work	
Lockout / Tag Out		JSA's / SJSA	X	Illumination	X	Utility Proximity	
Guards, Barriers		Warning Signs		Ground Protection	X	Confined Space	
Override		Variance				Energy Isolation	
Emergency Stops		MSDS (SDS)				Excavation	
GFCI	X						

Notes: Make any site specific notes on SJSA form (Doc# SF-2.4, Revised 04/30/2014). Make notes to improve JSA quality here, and turn in copy to CDLP EHS.

JSA Title:	Decontamination of Equipment (Pressure Washer & Steam Cleaner)						
Step No: Logical order	**Sequence of Job Steps** Break down Job into steps.	**Potential Hazards & Impacts** Identify hazards faced at each step of the task. Identify what may happen if the hazard is not effectivelycontrolled.	**Risk Rating** before action	**Procedure or action required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies	**Risk Rating** following action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**
1	Decon set up	Contact with moving equipment & pedestrian traffic		˅ Always use a spotter when backing. ˅ Set up on level ground and chock wheels. ˅ Only move trailer w/ forklift w/ proper hitch attachment ˅ Use caution when uncoupling trailer – Be aware of side pressure on tongue and stay out of line of fire. ˅ Set up exclusion zone around decon station ˅ Gloves must be worn when involved in a task requiring the use of hands. Gloves must be cut resistant level 3 and must be appropriate to the task, and "impact resistant"			
		Slip/trip/fall hazards – hoses, tools		˅ Keep hoses coiled or tucked out of the way if not in use. ˅ Place buckets, plastic and equipment in a level area away from other site activities conducted at the site. ˅ Keep work area neat with equipment properly stored to avoid trip hazards. ˅ Maintain good housekeeping. ˅ Close all drain plugs (decon trailers, etc.)			
		Back strain and Pinch Points – loading & unloading equipment		˅ Do not lift over 50 pounds without assistance. ˅ Bend knees, keep straight back, lift with legs, do not twist. ˅ Carefully place, do not throw, heavy tooling into decon. ˅ Wear appropriate gloves to protect hands from potential contamination, sharp steel, pinch points, and heavy tools.			
2	Steam cleaner and Pressure Washer inspection	Fire		˅ Fire extinguisher must be accessible nearby. ˅ Wet down dry grass, leaves, or other combustibles nearby. ˅ Be sure the steamer is inspected and connected properly. ˅ Always shut down prior to refueling equipment. ˅ Use internal combustion equipment in well ventilated area			
		Contact with flames or hot water		˅ Wear appropriate gloves to protect from heat. ˅ Keep other people clear of the operation. ˅ Keep both hands on the wand handles at all times. ˅ Minimum 48 inch wand. ˅ Maximum 3500 psi. > 3500 psi variance required ˅ No cutting tips allowed. (Use only the Green, or White Tips). Zero rated tips are not allowed. ˅ Direct spray at equipment and be cautious of overspray.			

3	Loading Tooling onto decon unit	Contact with Pinch Points, shifting loads		• Communicate w/ co-worker when lifting heavy tooling. • Do not stack casing/auger in the back of the decon • Always chock tooling to prevent rolling out of unit. • *Confirm drill tooling is **properly secured** with appropriate chocking device to prevent rolling, or shifting during task.* • *Chocking bar should be used to hold (staged) drill pipe in place, while 1 pipe is being decontaminated. **NOTE:** pipe being decontaminated will also have chocking bar to secure & prevent it from rolling forward on its own.* • *Thoroughly **inspect ALL** tooling for sharp 'metal edges' or damage that could cut, pinch, or "catch" on hand/fingers.* • ***Required gloves**: cut level III, task appropriate & "impact resistant" must be used during task* • *Proper engineering controls should be in place to prevent the augers from rolling forward, prior to decon task.*			
4	Pressure Washer and Steam Cleaner operation (Decon of Tools, Augers, Rods, Casing, Tooling, etc.	Contact with - Electrical shock hazard		• Verify electrical equipment is connected with a GFCI. • Inspect electrical switches and cords for abrasions, cuts, wear prior to use.			
		Exposure to Noise		• Wear proper hearing protection. • Shut down if pedestrians or others not wearing proper PPE approach.			
		Contact with and Exposure to High Pressure		• **Keep both hands on wand at all times** – Never hold an item with one hand while spraying it with the other. • Keep wand aimed at equipment. Never point wand at any person. Ensure wand is correct length for task. • Verify all personnel are out of the line of fire during decon activities. • Be aware of and prevent overspray.			
		Contact with Flying debris Exposure to contaminated soils		• **A Faceshield is required** when using pressure washer. • Wear appropriate gloves to protect against contaminated soils, as well as cuts, impact, and heat. • Keep others away from decon operations and shut down if others approach. **Vapor Exposure hazard, and state that PID monitoring will be performed, with an Action Level of 0.5 ppmv based on Vinyl Chloride – where workers should pause work and move away from the source, and if necessary don APR with OV cartridges.**			
		Slips/trips/falls		• Keep hose(s) coiled or tucked out of the way. • Keep tools organized and out of pathways. • Use caution if stepping on plastic which is very slippery when wet. • Know that plastic can cover and hide trip hazards such as curbs, potholes, etc.			

		Exposure to Cold Temperatures		• Be aware of potential for ice to form around decon unit and apply sand/salt as needed.		
5	Cleanup	Exposure to contamination from contaminated soils and spills Sprain/Strain from moving drums		• Use caution when transferring decon water to drums. • Do not allow decon water to splash personnel or spill to ground. • Shovel washed soils from unit and contain in drums. • Seal all drums tightly. • Use drum dolly or approved method to handle/move drums. Always use mechanical advantage. • Get assistance as needed. • Use liftgate or other equipment to move drums long distances, up steep slopes, or across rough terrain.		

Severity	Employee Injury	Environmental Damage	Property/Equipment Damage	Reputation Impact	Not Likely (Low)	Unlikely (Moderate)	Reasonably Likely	Highly Likely
	First Aid Treatment	Minor Impact on Environment	Negligible damage to Property, System or Equipment (under $1,000)	Internal Cascade Drilling LP impact only	1	2	4	7
	Requires Medical Treatment	Severe impact on environmental but easy rectified	Minor damage to Property, System or Equipment ($1,000-$5,000)	Local site impact involving Cascade Drilling LP and Cascade Drilling LP Contractors. Managed internally	3	5	8	12
	Severe injury - Fractures, Lost time injury or less than or equal to 7 days	Severe impact on environment requiring significant time to rectify	Medium level damage to Property, System or Equipment ($5,000 - $15,000)	Cascade Drilling LP Client impact on local site. Managed in coordination with Client	6	9	11	16
	Major Injury - Lost time injury more than 7 days	Major but repairable damage to the environment	Extensive Damage to Property, System or Equipment ($15,000 - $50,000)	Cascade Drilling LP Client impact on multiple sites. Incident response controlled by client. Operations closed by Client. Potential loss of Contract	10	13	17	18
	Fatality - Permanent Disability	Permanent & Irreparable Damage to Environment	Loss of major or Business critical Property, System or Equipment ($50,000 +)	National Media involved. Client impact. Loss of current Contract	14	15	19	20

Score	Risk	Action
1-5	Low Risk	Continue to Monitor and Control
6-12	Moderate	Follow Procedure & Interim Controls can be used
13-17	Significant	Stop Work as needed. Interim Controls must be used
18-20	Extreme	Stop Work and Control Hazard before work resumes

Note: Risk score between 13-20 requires a JSA or Work Instruction prior to commencement of job

Additional Job Tasks

Step No: Order	**Sequence of Job Steps** Break Down Job Into Steps	**Potential Hazards & Impacts** Identify Hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** per Action	**Procedure or Action Required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies.	**Risk Rating** Post Action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**

EMPLOYEE NAMES:	EMPLOYEE SIGNATURES:	DATE:

A signed copy of this JSA <u>MUST</u> be posted on-site and be available to any employee upon request.

JSA DEBRIEF

DATE & TIME	Participants	What Went Well	Lessons Learned

Name of Person filling out form:
Date:

CASCADE DRILLING | TECHNICAL SERVICES

JOB SAFETY ANALYSIS

Hand Auger & Post Hole Digger Use

JSA Prepared By: Operations Managers, Drillers, Supervisors, EHS Dept

JSA Approved By: EHS Department

Date: 10/20/2020

JSA Number: GEN029

Site: Columbia Cement Co

Types of Hazards Anticipated:

Safety	Y	Safety	Y	Health	Y	Health	Y	Environmental	Y	Environmental	Y
Struck By (SB)	x	Fall to Below (FB)	x	Noise		Oxygen Deficiency		Heat Stress		Water Contaminations	
Struck Against (SA)		Overexertion (OE)	x	Silica		Bloodborne pathogen		Cold Stress, Ice & Snow		Ground/Soil Contamination	
Contact By (CB)		Exposure (E)		Asbestos		Musculo-skeletal		Wind		Release to Ground	
Contact With (CW)	x	Electric Shock (ES)		Other Dust		Fauna (bears, snakes, etc)		Lightning			
Caught On (CO)				Hazardous Chemical		Insects (ticks, bees, spiders, etc)		Visibility (Fog)			
Caught In (CI)				Hydrogen Sulfide		Flora (poison ivy, etc)		Soil Stability			
Caught Between (CBT)	x			Carbon Monoxide				Habitat destruction			
Fall-same level (FS)	x			Methane				Air Contamination			

Type of PPE required if marked with 'X' (must be in accordance with CDLP PPE Program requirements):

												
X	X	X	X	X	X	☐	☐	☐	☐	☐	☐	☐
Task Appropriate Gloves	Hearing Protection (min 25 dB)	ANSI Z89.1 Hard Hat	ANSI Z87.1 Safety Glasses	ASTM F2413 Steel Toe Boots, Metatarsal	ANSI High Vis Vest (or Outerwear)	Safety Goggles	Dust mask	APR	SCBA	Face shield / protective hood	Welding or Chemical protective suit	Fall protection

Other PPE Required:

Other Controls required if marked with 'X':

Engineering Controls		Administrative Controls		Environmental Controls		Permits	
Interlock		Training		Ventilation		Hot Work	
Lockout / Tag Out		JSA's / SJSA		Illumination		Utility Proximity	X
Guards, Barriers		Warning Signs		Ground Protection		Confined Space	
Override		Variance				Energy Isolation	
Emergency Stops		MSDS (SDS)				Excavation	
GFCI							

Notes: Make any site specific notes on SJSA form (Doc# SF-2.4, Revised 04/30/2014). Make notes to improve JSA quality here, and turn in copy to CDLP EHS.

JSA Title:		Hand Auger & Post Hole Digger Use					
Step No: Logical order	**Sequence of Job Steps** Break down Job into steps.	**Potential Hazards & Impacts** Identify hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** before action	**Procedure or action required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies	**Risk Rating** following action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**
1	Set up equipment at boring location.	Contact with moving vehicles	12	• Use vehicle as traffic control barrier. Always face oncoming traffic. • Use approved traffic control plan when working in roadway. • Make eye contact with pedestrians and vehicle operators on site. • Communicate potential hazards with onsite personnel.	6		
		Contact with utilities		• Verify utility locates have been completed. Stop Work if in doubt. • Identify and avoid overhead power lines and other obstructions.			
2	Clear borehole to client specification	Fatigue, Strain/sprain – from strenuous physical labor, repetitive motion and lifting	8	• Take frequent breaks; Stay hydrated. • Wear nitrile gloves for contaminated soils. • Monitor air quality; don respirator or stop work if necessary. Refer to HASP for monitoring requirements and action levels • Keep face clear of borehole and work upwind, if feasible. • Stage extracted soil on plastic sheeting to avoid contact with clean surface – or place directly in 5 gallon bucket or 55 gallon drum. • Use proper lifting techniques to move and set up equipment. Stretch arms, legs and back before beginning task.	3		
		Contact with Pinch Points		Gloves must be worn when involved in a task requiring the use of hands. Gloves must be cut resistant level 3 and must be appropriate to the task			
		Back strain from use of hand auger		• If auger gets stuck in borehole, have two people assist with freeing it, avoid jerking motions. • Use kneepads when kneeling. • Maintain neutral body position.			
		Stuck by hand auger		• Use caution to avoid striking self or others w/ T-handle.			
		Slip, Trip		• Keep equipment organized such that nonessential equipment is store out of the immediate work area.			

3	Backfill soil boring with grout.	Slip, Trip open borehole	8	• Temporarily cover borehole with cone and delineation if moving to next location.	3		
		Back strain when backfilling.		• Do not leave tools near open borehole. Keep work area clean and organized. • Use proper lifting techniques to move and set up equipment. • Maintain neutral body positions.			

Severity	Employee Injury	Environmental Damage	Property/Equipment Damage	Reputation Impact	Not Likely (Low)	Unlikely (Moderate)	Reasonably Likely	Highly Likely
	First Aid Treatment	Minor Impact on Environment	Negligible damage to Property, System or Equipment (under $1,000)	Internal Cascade Drilling LP impact only	1	2	4	7
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	Severe injury - Fractures, Lost time injury or less than or equal to 7 days	Severe impact on environment requiring significant time to rectify	Medium level damage to Property, System or Equipment ($5,000 - $15,000)	Cascade Drilling LP Client impact on local site. Managed in coordination with Client	6	9	11	16
	Major Injury - Lost time injury more than 7 days	Major but repairable damage to the environment	Extensive Damage to Property, System or Equipment ($15,000 - $50,000)	Cascade Drilling LP Client impact on multiple sites. Incident response controlled by client. Operations closed by Client. Potential loss of Contract	10	13	17	18
	Fatality - Permanent Disability	Permanent & Irreparable Damage to Environment	Loss of major or Business critical Property, System or Equipment ($50,000 +)	National Media involved. Client impact. Loss of current Contract	14	15	19	20

Score	Risk	Action
1-5	Low Risk	Continue to Monitor and Control
6-12	Moderate	Follow Procedure & Interim Controls can be used
13-17	Significant	Stop Work as needed. Interim Controls must be used
18-20	Extreme	Stop Work and Control Hazard before work resumes

Note: Risk score between 13-20 requires a JSA or Work Instruction prior to commencement of job

Additional Job Tasks

Step No: Order	**Sequence of Job Steps** Break Down Job Into Steps	**Potential Hazards & Impacts** Identify Hazards faced at each step of the task. Identify what may happen if the hazard is not effectively controlled.	**Risk Rating** per Action	**Procedure or Action Required** Determine the actions necessary to reduce risk to an acceptable level. Record responsibility for the action as applies.	**Risk Rating** Post Action	**Responsible Person(s) - Initials**	**Mitigation on Steps Verified**

EMPLOYEE NAMES:	EMPLOYEE SIGNATURES:	DATE:

A signed copy of this JSA <u>MUST</u> be posted on-site and be available to any employee upon request.

JSA DEBRIEF

DATE & TIME	Participants	What Went Well	Lessons Learned

Name of Person filling out form:
Date:

JOB SAFETY ANALYSIS	DATE 06/20/2021	☐ NEW ☒ REVISED	AQUIFER DRILLING & TESTING

Site Location: Columbia Cement Co	WORK TYPE: Drilling	WORK ACTIVITY (Description): Hollow Stem Auger Soil Borings /Well Installation	
DEVELOPMENT TEAM	**Signature / Title**	**REVIEWED BY:**	**POSITION / TITLE**
Shawn Miller	Operations Manager	William Poupis	General Manager
John Diamond	Field Services Coordinator		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots/shoes	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Truck-Mounted Drilling Rig or Track Rig, Saw, Hand Tools, Interface Probe, 20 lb. Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs

COMMITMENT TO SAFETY - All personnel onsite will actively participate in Cascade Card Hazard Recognition throughout the day.

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed) **See Site Set-Up JSA**	1a. **Contact**: equipment/property damage	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel moves into the path of the drilling rig, the drilling rig will be stopped until the path is again clear. 1a. Set-up the work area / position equipment in a manner that eliminates or reduces the need for backing of trucks and trailers. 1a. Use a spotter for all required backing operations. 1a. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Drill rig should have an **exclusion zone of 20 feet** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation.
	1b. **Fall**: slip/trip/fall hazards	1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
2. Raising tower/derrick of drilling rig	2a. **Contact**: overhead hazards	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. 2a. ExxonMobil requirements for raising a tower/derrick in the area of overhead wires must be reviewed prior to drilling. 2a. The tower/derrick must not be raised beneath overhead power lines unless approved by both the ExxonMobil and Aquifer Drilling PMs. 2a. Maintain a safe distance from overhead structures. 2a. Do not move the rig while the tower/derrick is raised.
	2b. **Contact**: Pinch Points when raising the rig and unstablity of rig	2b. Inpect the equipment prior to use and avoid pinch points. 2b. Lower out riggers on rig to ensure stability prior to raising rig tower/derrick. 2b. If the rig needs to be mounted, be sure to use 3-points of contact.
3. Advancement of augers for soil borings and well material installation	3a. **Contact**: flying / spraying debris	3a. Wear required PPE (especially hand, eye, ear and respiratory protection). 3a. Be aware of and avoid potential lines of fire.
	3b. **Exposure**: noise and dust	3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep body away from rig. 3b. Wear hearing protection when the drill rig is in operation and/or the

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

		noise levels exceed 85db.
	3c. **Caught**: limb/extremity pinching; abrasion/crushing	3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3c. Inspect the equipment prior to use for potential pinch points. 3c. Test all emergency shutdown devices prior to drilling. 3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 3c. Inspect augers, do not use if auger flight if damaged or bent. 3c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment particularly when installing auger flights and steel override casings. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning augers should have an **exclusion zone of 2 feet** when inoperation.
	3d. **Contact**: equipment imbalance during advancement drill equipment and installing steel override casing	3d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3d. The blocking and leveling devices used to secure the rig will be inspected by Aquifer Drilling personnel regularly to see if shifting has occurred. 3d. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 20 feet**). 3d. When lifting and lowering steel override casing into borehole, personnel that are non-essential will be positioned away from direct line of fire incase casing falls over or swings during advancement.
	3e. **Exposure**: inhalation of contamination/vapors	3e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area. 3e. The Action Level for breathing zone air is five parts per million (sustained) as detected by the PID. 3e. If a reading of >5ppm is recorded, the Aquifer Drilling field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Aquifer Drilling PM of the condition. The Aquifer Drilling PM will then recommend additional appropriate precautions in accordance with the site specific health and safety plan.
	3f. **Fall**: slip/trip/fall hazards	3f. See 2a. 3f. Remove soil cuttings to avoid a tripping hazard from developing near augers.
	3g. **Exertion**: Installing well casings and lifting augers	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lb. 3g. Use mechanical lifting device for odd shaped objects.
4. Decontaminate equipment	4a. **Exposure:** to contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors)	4a. Wear chemical-resistant disposable gloves and safety glasses. 4a. Contain decontamination water so that it does not spill. 4a. Use an absorbent pad to clean spills, if necessary.
	4b. **Exposure**: to chemicals in cleaning solution including ammonia	4b. See 5a.

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JOB SAFETY ANALYSIS	DATE: 06/02/2021	☐ NEW ☒ REVISED	Aquifer Drilling & Testing

Site Location: Columbia Cement Co	**WORK TYPE:** Drilling/Abandonment/Surface repair or Replacement	**WORK ACTIVITY:** Monitoring Well Abandonment – Pull and Grout- Manhole repair – Manhole Replacement- Manhole Removal- Over Drill and Remove	
DEVELOPMENT TEAM	**Signature / Title**	**REVIEWED BY:**	**POSITION / TITLE**
Dennis Mayer	Opeations Manager	William Poupis	Genral Manager
Shawn Miller	Field Services Coordinator		
Chris Migliore			

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Insulated, Leather, Nitrile and cut resistant
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED AIR RESPIRATOR	☒ OTHER: Insect Repellant, sunscreen (as needed)Dust mask(as needed)
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Truck Rig or Track Rig, Trailer, 42 inch Safety cones and flags, Interface Probe and/or Water Level Meter, Photoionization Detector, Appropriate Power Sources, Air Compressor, 20 lb. Fire Extinguisher, 55-Gallon Drums or Holding Tanks, Buckets, Caution Tape, Tools as needed: Socket Wrench, Pipe Wrench, Screw Driver, Crow Bar, Mallet, Vault Key.Air compressor, Jack hammer, concrete mixer.

Commitment to Safety – All personnel onsite will actively participate in Cascade Card hazard recognition throughout the day.

EXCLUSION ZONE: A minimum 10' exclusion zone will be maintained around the rig.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization / demobilization	1a. **CONTACT:** Equipment/property damage	1a. The rig's tower/derrick will be lowered and secured prior to mobilization. 1a. Personnel will maintain a 10' minimum exclusion zone while the rig is moving to setup 1a. Set-up the work area / position equipment in a manner that eliminates or reduces the need for backing of trucks and trailers. 1a. Use a spotter for all required backing operations.
	1b. **FALL:** Slip/trip/fall hazards	1b. Inspect the driving and walking paths for uneven terrain and weather-related hazards. Level or avoid if needed. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
2. Open/close well	2a. **EXERTION:** Muscle strain (some wells have large vault covers)	2a. Keep back straight, lift with legs, keep load close to body, and never reach with a load, balance to reduce the potential for muscle strain. Two people are required when lifting objects over 50 lbs or when the shape makes the object difficult to lift.
	2b. **CAUGHT:** Pinch points associated with removing/replacing manholes and working with hand tools	2b. Wear leather gloves when working with well vault/cover and hand tools. 2b. Use ratchet and pry bar for well cover and inspect before use. 2b. Do not put fingers under well vault/cover.
	2c. **EXPOSURE:** Potentially hazardous vapors	2c. No open flames/heat sources. 2c. Allow well to vent after opening it and before abandonment activities begin to minimize exposure to vapors. 2c. Work on the upwind side of well.
	2d. **CONTACT:** Traffic	2d. Identify direction of potential sources of traffic. 2d. Delineate work area with 42" safety cones, caution tape, and/or other barriers. Additional safety cones will be used in high traffic areas. Position vehicle to protect against oncoming traffic. 2d. Maintain awareness of traffic. 2d. Wear Fluorescent Reflective Vest or High-visibility Clothing.
3. Raising tower/derrick of drilling rig	3a. **CONTACT:** Overhead hazards	3a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. Maintain a safe distance from overhead structures. 3a. Do not move the rig while the tower/derrick is raised.
4. Well material removal/grouting of borehole	4a. **CONTACT:** Flying debris	4a. Be aware of and avoid potential lines of fire. 4a. Hard hats and safety glasses will be worn at all times in work areas.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
	4b. **EXPOSURE:** Noise and dust	4b. Wet borehole area with sprayer to minimize dust. 4b. Stand upwind and keep body away from rig. 4b. No open flames/heat sources. 4b. Grout material will be poured at a rate that will not create excess dust. 4b. Wear hearing protection when the drill rig is in operation and/or the noise levels exceed 85dBA.
	4c. **CAUGHT:** Limb/extremity pinching; abrasion/crushing	4c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 4c. Inspect the equipment prior to use for potential pinch point hazards. 4c. Test all emergency shutdown devices prior to drilling. 4c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 4c. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment. 4c. Steel-toed or Composite-toed boots/shoes will be worn at all times while in work areas. 4c. Drillers and helpers will understand and use the “Show Me Your Hands” Policy.
	4d. **CONTACT:** Cable/wench line snap equipment	4d. Winch line and/or cable should be firmly attached to well material prior to initiating the pull. 4d. Do not use frayed cables and lines under tension. 4d. Maintain Exclusion zone = to the height of boom.
	4e. **EXPOSURE:** Inhalation of contamination	4e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area. 4e. If a reading of >5ppm is recorded, the Aquifer Drilling field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Aquifer Drilling PM of the condition. The Aquifer Drilling PM will then recommend additional appropriate precautions in accordance with the site specific health and safety plan. 4e. Grout material will be poured at a rate that will not create excess dust.
	4f. **FALL:** Slip/trip/fall hazards	4f. See 1b.

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