Remedial Action Work Plan Former Dowell Depew Facility 3311 Walden Avenue, Depew, New York

August 2015

Prepared for:

Schlumberger







Remedial Action Work Plan Former Dowell Depew Facility

3311 Walden Avenue, Depew, New York

Prepared for New York State Department of Environmental Conservation

On Behalf of Schlumberger Technology Corporation and The Dow Chemical Company

August 2015



Engineer Certification

"I <u>Key Rosebrook</u> certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10)."



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Abbreviations and Acronyms

°C	degrees Celsius
1,1,1-TCA	1,1,1-trichloroethane
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
1,2-DCE	1,2-dichloroethene
AS	air sparge
bgs	below ground surface
CH2M	CH2M HILL Engineers, Inc.
cis-1,2-DCE	cis-1,2-dichloroethene
cm/sec	centimeters per second
COC	chemical of concern
DAR	Division of Air Resources
Dow	The Dow Chemical Company
ERD	enhanced reductive dechlorination
EMP	environmental management plan
ERH	electrical resistance heating
FER	final engineering report
ISCO	in situ chemical oxidation
ISTT	in situ thermal treatment
NAPL	non aqueous phase liquids
NYSDEC	New York State Department of Environmental Conservation
PID	photoionization detector
POTW	publicly owned treatment works
PVC	polyvinyl chloride
RA	remedial action
RAO	remedial action objective
RAWP	remedial action work plan
SCG	applicable standards, criteria, and guidelines
site	Former Dowell Depew Facility
STC	Schlumberger Technology Corporation
SVE	soil vapor extraction
ТСН	thermal conductive heating
TMP	temperature monitoring point
TTZ	target treatment zone
VCP	Voluntary Cleanup Program
VGAC	vapor phase granular activated carbon
VMP	vacuum monitoring points
VOC	volatile organic compound

Introduction

This remedial action work plan (RAWP) was prepared for Schlumberger Technology Corporation (STC) and The Dow Chemical Company (Dow) as part of the New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Program (VCP) for the Former Dowell Depew Facility (site) located in Depew, New York. This RAWP presents the remedial action objective (RAO) and implementation plans for the proposed remedial action (RA) to be performed at the site. The RAWP was prepared in accordance with the NYSDEC Program Policy document—DER-10/Technical Guidance for Site Investigation and Remediation (NYSDEC 2010) and the site management plan (URS Corporation 2011) for the periodic submittal of data, information, recommendations, and certifications to the NYSDEC. The RA proposed in this RAWP is the construction, operation, and decommission of an in situ thermal treatment (ISTT) system to treat onsite volatile organic compound (VOC)-impacted groundwater.

1.1 Purpose of Remedial Action Work Plan

The purpose of the RAWP is to provide a comprehensive summary of the project objectives, site description/history, previous investigations, and RAs, along with a detailed description of RA activities proposed for the site. The RAWP will be used as a guidance document to be followed by CH2M HILL Engineers, Inc. (CH2M) and its subcontractors to successfully complete the RA. The RA activities and procedures described in this document will be implemented in the field during site remediation.

1.2 Project Objectives

RAOs are medium-specific goals that the RA is expected to meet to protect human health and the environment and to comply with the applicable or relevant and appropriate requirements. RAOs guide the formulation and evaluation of remedial alternatives. The following RAO was established based on the nature and extent of contamination, the resources that are currently and potentially threatened, and the potential for human and environmental exposure:

• Reduce VOC concentrations in onsite groundwater to below applicable standards, criteria, and guideline (SCG) values to enable the removal of the institutional controls that prohibit groundwater use without treatment and require long-term monitoring from the property deed.

1.3 Organization of Remedial Action Work Plan

The work plan is organized as follows:

- Section 1 Introduction
- Section 2 Background
- Section 3 Remedial Action Plan
- Section 4 References
- Appendix A Target Treatment Zone Technical Memorandum
- Appendix B Health and Safety Plan
- Appendix C ISTT Soil Sampling Methodology
- Appendix D Environmental Management Plan
- Appendix E Community Air Monitoring Plan

Background

Section 2 presents the site description, operational history of the facility, previous site investigations and RAs, geology and hydrogeology, and the nature and extent of groundwater contamination. The nature and extent of soil contamination was not included in this RAWP. Previous RA activities have remediated residual soil contamination to the restricted commercial use. Residual soil contamination will be re-evaluated to assess potential risk and to determine if long-term management is still warranted.

2.1 Site Description

The site is east of Buffalo, New York, at 3311 Walden Avenue in the Village of Depew (Figure 2-1). The site is in a mixed residential and industrial/commercial area. Properties surrounding the site include Walden Avenue to the north, a CSX railroad yard to the south, a lumber yard and supply store (84 Lumber) to the east, and a mattress manufacturer (Buffalo Batt and Felt) to the west (Figure 2-2). A residential neighborhood and a recycling facility (EnviroSense Corp.) are adjacent to the site on the north side of Walden Avenue.

The approximately 1.8-acre site is relatively flat with a gentle downward slope to the north–northwest toward Walden Avenue. Maximum relief across the site (that is, from south to north) is about 4 feet, and surface water flows from south to north across the site. The property is currently vacant, and the ground surface consists primarily of gravel and grass with small- to medium-sized trees on portions of the site. A 6-foot-high chain-linked fence with a locked entrance gate along Walden Avenue surrounds the site.

2.2 Operational History

Former activities at the site included servicing industrial facilities and limited oilfield-related projects. Various industrial cleaning and oilfield-related chemicals were stored onsite and transferred into tank trucks for use at different job sites (URS Corporation 2004). A former railroad siding, which has been removed, traversed the site from east to west. Former onsite building structures included the following: a two-story office building, a chemical storage building, a one-story office/maintenance shop, an acid plant, a bulk cement plant, cement silos, an 8,000-gallon diesel aboveground storage tank, a 1,000-gallon gasoline underground storage tank with dispenser, a mud separator, an oil/water separator, and a hydrochloric acid aboveground storage tank (Figure 2-2). In the late 1980s, operations at the site were discontinued, and the facility was permanently closed. Building structures were razed during the 2003 to 2004 RA, and the site has been inactive since (URS Corporation 2011).

2.3 Previous Site Investigations and Remedial Actions

Site investigations and RAs were performed after site operations were discontinued. A chronology of the site investigations and remedial actions is presented in Table 2-1.

2.4 Geology and Hydrogeology

2.4.1 Geology

Surface soils encountered during the previous RAs at the site consisted of a fill layer composed of poorly sorted sands, silts, clay, gravel, and cinders that are approximately 0 to 4 feet thick. Underlying the fill layer is a regional glacial till deposit approximately 25 feet thick. The till is composed of unsorted clay, silt, fine sand, and fine to coarse gravel that exhibits low permeability. Subtle lithologic variations in the glacial till with depth indicate that two subunits, which have previously been identified in historical reports as the upper and lower units, are present within the till. The upper till is composed of unsorted silty clays and clayey silts that are light brown to brown in color, moist to wet, stiff to very stiff, slight to moderately plastic, and contain little to trace fine-grained sands and subangular to subrounded glacial erratics (that is, pebbles

and cobbles). The upper till transitions to the lower till at a depth of approximately 18 to 20 feet below ground surface (bgs). Similar to the upper till, the lower till is also composed of unsorted silty clays and clayey silts; however, unlike the upper till, the lower till is dark brown to dark grey in color, damp, stiff, slightly plastic, and contains a higher percentage of embedded subangular to subrounded glacial erratics with depth. Underlying the till is the Marcellus and Skaneateles Shale formations (Geraghty & Miller 1990). These rock formations are present throughout the southern half of the Erie-Niagara Basin and locally contain thin interbedded limestones. The Shale formations typically produce small quantities of groundwater ranging from 10 to 15 gallons per minute. The overlying glacial till deposit is an insignificant source of groundwater for the area.

2.4.2 Hydrogeology

Previous site investigation reports identified two independent groundwater units (defined as the upper and lower till units). The upper till unit is unconfined groundwater present in the fill material and upper till, and the lower till unit is confined groundwater in the lower till and upper bedrock. Flow in the upper, unconfined unit is to the north-northwest, whereas flow in the deeper, confined lower till/bedrock unit is to the westnorthwest. Additionally, in situ hydraulic conductivity testing was performed on selected monitoring wells during previous site investigations to ascertain the hydraulic properties of the upper and lower till units. With the exception of MW-05, which has since been abandoned, the slug test data presented a range of hydraulic conductivity of the glacial till deposit at the time of the investigation was approximately 1.18×10^{-5} centimeters per second (cm/sec) (URS Corporation 2003).

Groundwater elevation measurements for the June 2014 annual site monitoring event are presented in Table 2-2. Figure 2-3 presents the potentiometric surfaces for the upper and lower till units as measured in June 2014. The general groundwater flow direction for both lithologic units in relation to the VOC-impacted site monitoring wells (that is, MW-06S and MW-06D) is to the west and to the northwest, which is consistent with past measurements and flow directions (URS Corporation 2013).

2.5 Nature and Extent of Groundwater Contamination

Following the completion of the May 2004 RA, a long-term groundwater monitoring program was implemented to monitor VOC-impacted groundwater. Groundwater samples were collected from site monitoring wells quarterly from July 2004 to December 2009 and from September 2011 to July 2013. In June 2009, six injection wells were installed to implement in situ chemical oxidation (ISCO) to reduce VOC concentrations in site monitoring wells MW-06S and MW-06D. Approximately 375 gallons of hydrogen peroxide and sodium persulfate were injected between August and November 2009 (URS Corporation 2010). Groundwater samples collected from MW-06S and MW-06D between September 2011 and July 2013 indicated that the injection program had minimal impact on VOC concentrations in either site monitoring well. After the completion of the July 2013 sampling event, the long-term groundwater monitoring program was modified. The sampling frequency was reduced from quarterly to annual sampling, and the monitoring well network was reduced to MW-06D, RW-01, MW-07S, and MW-07D.

Table 2-3 and Figure 2-4 present the analytes detected in groundwater during the June 2014 annual monitoring event. Ten VOCs were detected, and eight VOCs exceeded SCG values at one or more groundwater or recovery well. The eight VOCs exceeding SCG values are 1,1,1-trichloroethane (1,1,1-TCA), 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-1,1-dichloroethane (1,2-DCA), total 1,2-DCE, chloroethane, cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (Figure 2-4).

Analysis of the annual monitoring data indicates that remaining groundwater contamination exceeding SCG values onsite is still limited to the area around monitoring wells MW-06S and MW-06D (CH2M 2014); however, because of the distance between existing site monitoring wells, the lateral extent of onsite VOC-impacted groundwater had not been adequately defined to design a remedy for the site. In January and April 2015,

CH2M conducted a target treatment zone (TTZ) investigation on behalf of STC and Dow to define the lateral extent of onsite VOC-impacted groundwater so that an appropriate remedy could be selected to address the residual onsite groundwater contamination. The results of TTZ investigation are presented in the TTZ technical memorandum that is provided as Appendix A. The following key observations and conclusions were made based on the geotechnical and analytical results of the media samples collected during the TTZ investigation:

- Twenty-five VOCs were detected in one or more temporary monitoring well locations, and 14 of those VOCs exceeded their SCG value.
- The 14 VOCs that exceeded their SCG values are 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCA, total 1,2-DCE, acetone, benzene, chloroethane, cis-1,2-DCE, ethylbenzene, tetrachloroethene, trichloroethene, vinyl chloride, and total xylenes.
- The highest VOC concentrations were generally detected in groundwater samples collected from temporary wells close to monitoring wells MW-06S, MW-06D, and RW-01, that is TW-01S, TW-03S, and TW-04D.
- As shown in Figures 4 and 5 of the TTZ technical memorandum (Appendix A), the TTZ has been identified based on groundwater results from the TTZ investigation. Based on the extent of SCG exceedances and the RAO, the TTZ is approximately 3,400 square feet and extends to the top of bedrock, which is 30 feet deep on average. As such, the total volume of the TTZ is estimated to be 102,000 cubic feet (or approximately 3,800 cubic yards).
- The geotechnical sample collected from the upper till within the TTZ had a porosity of 0.38 and a hydraulic conductivity of 6.2 x 10⁻⁵ cm/sec. additionally, the geotechnical sample collected from the lower till within the TTZ had a porosity of 0.22 and a hydraulic conductivity of 2.9 x 10⁻⁸ cm/sec.

Remedial Action Plan

The remedial action plan provides the rationale for and description of the selected remedy (ISTT); describes the permitting, construction, operation, and decommissioning of the ISTT system; and proposes the confirmation sampling plan to verify that the RAO is achieved. The ISTT subcontractor will be contracted to and overseen by CH2M on behalf of STC and Dow. The remedy will be implemented in compliance with this RAWP, as well as applicable federal, state, and local regulations and ordinances. RA activities will be completed in accordance with the site-specific health and safety plan provided as Appendix B. Upon completion of the RA, CH2M will prepare and submit a final engineering report (FER) to NYSDEC for review and approval. The FER will include sufficient details that document the work performed during the RA.

3.1 Remedy Selection

Given the RAO and the nature and extent of site contaminants, the following soil and groundwater remediation technologies were considered for the RA:

- Excavation
- ISTT
- Soil mixing using ISCO
- Air sparging (AS) with soil vapor extraction (SVE)
- Enhanced reductive dechlorination (ERD) or ISCO by hydraulic fracturing

Soil mixing with ISCO, AS/SVE, and hydraulic fracturing (with either ISCO or ERD) were rejected because each technology provided only moderate treatment confidence given the geologic and hydrogeologic site conditions (for example, challenges in distributing and mixing reagents in the tight aquifer matrix) and/or would be expected to take multiple years to reach treatment goals.

Both excavation and ISTT were considered to provide high treatment confidence. Ultimately, ISTT was selected for the site because excavation would have a much higher level of community disruption, increase liability from transporting contaminated material, and pose more potential hazards during implementation.

3.2 Description of Selected Remedial Technology

ISTT was originally developed to enhance secondary oil recovery in production wells. Thermal technologies are now being used to effectively and relatively quickly remediate sites with contaminated soil and groundwater. Thermal technologies involve the input of energy to the subsurface to raise the temperature and achieve contaminant removal by a combination of factors, including increasing the contaminant vapor pressure (to cause volatilization, with vapors collected by extraction wells) and increasing the microbial metabolic rate (to enhance biodegradation). In general, ISTT technologies tend to be broad-spectrum remediation tools. Because the mechanisms of contaminant removal are primarily physical, the treatment process is relatively unaffected by contaminant distribution, lithology, concentration, chemical structure, or toxicity.

The input of energy to the subsurface can be applied through different delivery methods, using electrical or fuel gas heating sources. The most common methods for subsurface heating include technologies based on electrical resistance heating (ERH) or thermal conductive heating (TCH) principals, the latter of which is sometimes referred to as in situ thermal desorption. Regardless of the heat delivery method, the propagation of heat is the driving force for contaminant removal from groundwater and soil. Heat transfer in the subsurface can occur by convection, conduction, and/or radiation. Convection and conduction processes dominate subsurface heat transfer; therefore, technologies incorporating these two mechanisms are the most commonly applied for thermal remediation.

The application of heat significantly accelerates the mobilization and removal of residual VOCs from the subsurface. Heating the subsurface to temperatures around the boiling point of water can lead to significant

changes in the thermodynamic conditions in the subsurface and can mobilize many organic contaminants to enhance subsurface removal processes. The two commercially available ISTT technologies, ERH and TCH, are described in the following subsections.

3.2.1 Electrical Resistance Heating

The ERH process involves the placement of multiple electrode groups in the subsurface and the application of an electrical current. Voltage is applied to the electrodes, causing current to flow through the subsurface formation from high potential at the electrode to low potential at the ground or neutral leg. The electrical resistance developed by the soil generates heat, which is transferred by conduction to heat the formation. The heat mobilizes the organic contaminants, which are collected as vapor or liquids by recovery wells incorporating dual-phase extraction.

There are multiple commercial suppliers of ERH-based heating systems, and the heating methodologies have been demonstrated on a wide array of contaminants in highly variable subsurface conditions. Electrodes are commonly fabricated based on formation properties, and multiple designs may be necessary for complete heating in heterogeneous sites. Subsurface heating relies on current flow; therefore, if insufficient soil moisture is present to conduct current, water addition from the surface may be required to keep the electrodes from drying out.

Infrastructure typical of ERH systems consists of electrode arrays, electrical power distribution equipment, vapor and groundwater extraction wells, and an aboveground treatment plant for extracted vapors and fluids. Electrodes are typically placed in arrays across the treatment area to ensure thorough site heating. Recovery wells are placed to capture contaminants in groundwater and vapor mobilized during heating

3.2.2 Thermal Conductive Heating

As with ERH, heat is generated with electricity using resistive principles. However, the TCH process relies on the resistive properties of a metal rod rather than the bulk soil. A typical heater assembly consists of a U-shaped metal rod approximately 0.5 inch in diameter that is installed in a section of sealed well casing. Ceramic insulators are used to electrically isolate the heating element from the steel casing. The application of electric power to the element causes the steel rod to heat resistively. Once the heater element is hot, radiant heat is transferred from the heater element to the steel casing that are installed (with sealed bottoms) within the formation. Heat is then transferred by conduction from the casing to the surrounding soil and groundwater. Depending on the target temperature, the groundwater boils to generate steam, which rises due to density differences. The steam rises until it is captured by the vapor recovery system or condensed by cooler groundwater or soil. Upon condensation, the steam's latent heat is then transferred to the cooler media, thereby resulting in convective heat transfer. Heating continues until steam condensation no longer occurs and steam is captured by the vapor recovery system. The heating process is effective in both saturated and unsaturated portions of the subsurface. The TCH process is less susceptible than ERH to operational inefficiencies caused by drying of the soil, since the thermal conduction process does not rely on water saturation as an essential element for heat generation.

Although the previous process description focused on a TCH system premised on the use of electrical energy for heating, it should be noted that subsurface heating by TCH processes can also be accomplished using fuel gas. The field configuration of electrical- and gas-based thermal processes differs slightly, but both systems share similar subsurface heat transfer methods.

Infrastructure typical of TCH systems consists of electrical power distribution equipment (or fuel gas), vapor and groundwater extraction wells, and an aboveground treatment plant for extracted fluids and vapors. In application, multiple heater assemblies would be placed across the source area to ensure thorough site heating, and vapor recovery wells would be installed throughout the treatment area, or collocated with the heater wells, to capture groundwater and vapor mobilized during heating.

3.2.3 Ancillary Treatment Requirements

Either heating technology would be implemented in conjunction with ancillary systems designed to capture, extract, and treat mobilized contaminants. Aboveground water and vapor treatment systems associated with ISTT systems generally are constructed to withstand the elevated temperatures and extraction rates associated with these processes. Most ISTT applications for chlorinated solvents rely on vapor extraction as the primary contaminant removal mechanism, coupled with hydraulic extraction to maintain hydraulic gradient control within the treatment area. Aboveground, extracted vapor from the treatment zone is cooled by direct condensation. In some cases, vapor condensation can produce a mixture of water and nonaqueous phase liquid (NAPL), which must be subsequently treated. Though not anticipated at the site, an organic/water separator is typically applied for the management and collection of NAPL condensed from the extracted vapor stream.

Offgas treatment systems applied for thermal treatment projects are sized to treat higher and often highly varying concentrations produced during ISTT. Treatment technologies for extracted vapor also vary and are selected during detailed system design efforts. Traditionally, vapor treatment for ISTT has relied on the use of vapor-phase granular activated carbon (VGAC) adsorption or thermal oxidation. As noted previously, treatment of extracted groundwater and condensate is also required during ISTT system operation. Unit operations for water treatment are tailored for both the target contaminants and discharge requirements. Treatment operations incorporating liquid-phase VGAC, air stripping, media filtration, and pH adjustment are typical of ISTT operations that discharge vapors into the atmosphere or condensate into publicly owned sewerlines.

3.3 In Situ Thermal Treatment System Construction

Either ERH or TCH could be used at the site. The most appropriate ISTT technology (that is, ERH or TCH) will be determined by the thermal subcontractor selected during the procurement and design process. ISTT is a proprietary technology that is typically designed, constructed, and operated by specialty subcontractors. As such, preparation of detailed system designs will be completed by the selected thermal subcontractor after CH2M awards the subcontract.

The selected thermal subcontractor will furnish the labor, equipment, materials, lower-tier subcontractors, supplies, and other appurtenances necessary to completely install and operate the ISTT system. Drilling and construction management will be performed by CH2M. Operations will be led by the ISTT vendor, under CH2M management. Work will be completed in compliance with current federal, state, and local regulations and in accordance with standard industry practice and applicable technology licenses. The actual number of borings, extraction points, and subsurface monitoring equipment used and their locations will be determined during the design process.

There are many components that compose an ISTT system. The selection, design, and operation of the major components differ slightly among technology providers, but in general, ISTT systems include similar features. Major components of the ISTT system will include the following: the electrical power supply, groundwater and vapor extraction wells, heaters or electrodes, electrical controls for subsurface heating, and the ancillary process equipment to treat extracted soil vapor and groundwater generated during ISTT system operation. A conceptual layout of a potential ISTT system and existing utilities surrounding the site is presented in Figure 3-1, and a conceptual process flow diagram for a TCH system is presented in Figure 3-2; an ERH system would be comparable. The conceptual figures are for illustration purposes and could change following design and procurement.

Based on preliminary estimates, it is anticipated that the total treatment time will be less than 1 year.

3.3.1 Permits

CH2M and the selected ISTT subcontractor will obtain required permits for the selected ISTT technology prior to commencement of RA activities. RA activities will be performed in compliance with the provisions of those permits, which may include the following:

- Air Permit—based on preliminary estimates of contaminant mass in the TTZ, it is not anticipated that an air permit will be required from NYSDEC Division of Air Resources (DAR). Thresholds for minor source air permits are 2.5 tons per year of a single hazardous air pollutant, 5 tons per year of total hazardous air pollutants, 1,000 pounds per year of tetrachloroethene or trichloroethene, and 25 tons per year of total VOCs. The contaminant mass in the TTZ presented in Table 3-1 is estimated to be less than 100 pounds based on groundwater concentration and soil geotechnical data. Therefore, it is anticipated that the ISTT system will need to be registered with NYSDEC DAR, but not permitted.
- **Discharge Permit**—condensation from the ISTT treatment system components will be collected, treated as necessary, and discharged to the publicly owned treatment works (POTW) under a discharge agreement. CH2M will obtain written authorization from the City of Depew to discharge to the POTW prior to implementation.
- Injection Permit—depending upon the ISTT technology selected, an injection permit may be required. CH2M will obtain written authorization from the U.S. Environmental Protection Agency Region 2 Underground Injection Control Program to inject water as needed into subsurface prior to implementation.

3.3.2 Modifications to Existing Site Features

The proposed TTZ is located in the northwest area of the site and is currently covered with grass and remnant concrete and asphalt from the previous demolition and excavation efforts. It is not anticipated that structures or site features will need to be removed or repositioned to install the ISTT above- and below-grade components. The proposed TTZ is also within the limits of an existing 6-foot-high chain-linked metal fence, which might need to be replaced and/or rerouted depending on the selected technology.

The existing polyvinyl chloride (PVC) monitoring wells located within the TTZ will not be able to withstand the elevated temperatures in the subsurface during ISTT implementation (a minimum of 90 degrees Celsius [°C]). Therefore, as part of the drilling effort to install the heater borings and/or electrodes and the vapor recovery wells, existing PVC monitoring and injection wells within the TTZ will be overdrilled and grout-plugged by a well driller licensed in the state of New York in accordance with NYSDEC regulations. The wells to be overdrilled within the TTZ are presented in Figure 3-3 and include IW-01S, IW-02S, IW-03S, IW-04D, IW-05D, IW-06D, RW-01, MW-06S, and MW-06D. Because the selected remedy will remediate the residual groundwater contamination within the TTZ and because the remaining six site monitoring wells and 13 piezometers previously presented in Figure 2-2 are located outside of the TTZ, these monitoring wells and piezomenters will be abandoned after the residual groundwater contamination has been remediated.

3.3.3 Baseline Sampling

Baseline groundwater samples will be collected from the existing monitoring wells within the TTZ (that is, MW-06S, MW-06D, and RW-01) prior to abandonment and startup. Baseline soil samples (unsaturated and saturated) will be collected during heater boring or electrode installation to establish a basis for evaluating remedy effectiveness. Baseline groundwater and soil data will be used to calculate the total VOC mass in the TTZ. The mass removed during ISTT operation will be compared to the baseline levels to estimate when treatment has been completed and confirmation samples will be collected (see Section 3.5) to verify RAO compliance. The baseline total VOC mass calculation will also be used to verify compliance with air permitting requirements as discussed in Section 3.3.1. The exact number of baseline soil samples will be determined based on the selected ISTT technology and the number of electrodes/heater/vapor recovery points required for that technology. During the installation of the electrode/heater/vapor recover point, baseline soil samples will be collected from both the upper and lower till unit.

3.3.4 Site Preparation and Mobilization

Site preparation activities will include mobilization of personnel and equipment to the site and establishment of temporary facilities, portable sanitary facilities, decontamination area, storage trailer(s), and construction material and chemical staging area(s). The location of the staging area(s) will be selected based on site conditions, space availability, and implementation logistics. Site controls (such as access barricades, flagging, fencing, and signs) will be installed or upgraded to control unauthorized access to the site. The various work areas for site activities will be clearly marked and flagged.

Electrical power will be brought onto the site to establish the necessary power (voltage, phase, amperage) to operate the ISTT system. The electrical power will be interconnected with supporting hardware to transform, control, and regulate primary site power to the ISTT system.

3.3.5 Utilities

At a minimum of 2 full business days before the start of intrusive remedial activities, the New York "Dig Safely New York" number (811 or 800-962-7962) will be called to clear the TTZ and surrounding area likely impacted by remedial activities, and this includes the grass covered right-of-way between Walden Avenue and the north property fence. Previous utility clearances performed by both Dig-Safely New York utility representatives and Bloodhound Underground Utility Locators (CH2M's third-party utility locating company) have indicated that there are no existing utilities within the TTZ; however, an underground natural gas line is located within the right-of-way. The natural gas line is approximately 6 to 7 feet north of the existing fence line and is not expected to be impacted by the ISTT installation or operation effort.

3.3.6 In Situ Thermal Treatment System Components and Construction

Many of the ERH and TCH components are similar. This includes electrodes or heating wells, vapor recovery wells, extracted vapors and fluids conveyance piping, and a vapor recovery and treatment system. ISTT heater/electrode and vapor extraction wells, as well as temperature probes, will be installed using hollow-stem auger drilling techniques. Vertical wellheads, plumbing, and wiring will be installed abovegrade where possible.

Construction will begin with the installation of the vertical heater and vapor extraction wells, followed by installation of the vapor cap and surface connections. An office trailer will be used for housing data management computers and other monitoring equipment. The heating process will be automated, with data collection (for example, temperature and pressure readings) performed remotely with dataloggers to the extent practical. Operators will oversee the system and collect data and samples onsite as needed (discussed in more detail in Section 3.9). As the subsurface soils are heated, fluids will be extracted, cooled, separated, and treated. For either approach, the estimated duration of ISTT construction, operation, and decommissioning is approximately 9 to 12 months.

Additional system elements that are specific to ERH and TCH are discussed in the following subsections.

3.3.6.1 Electrical Resistance Heating

If ERH is selected as the remedial technology, the system would consist of electrodes spaced approximately 10 to 20 feet apart. Vapor recovery wells would be spaced a similar distance apart, or alternatively, could be collocated in the same borehole as the electrodes, depending on the selected ISTT subcontractor. Electrodes typically use two or more independent depth elements that allow for independent control of the electrical power input to various depths and make it possible to heat portions of the treatment volume sequentially, using strategies such as "bottom up" or "outside in" heating control. As necessary, a small volume of water

would be added during the heating phase to keep the soil immediately adjacent to the electrodes moist and electrically conductive. If ERH is selected as the most appropriate ISTT technology, then an injection permit would be obtained (if necessary) by CH2M and the selected thermal subcontractor to keep soil adjacent to the electrodes moist and conductive.

The ERH system would include site-specific power control units designed and assembled to deliver power continuously to the treatment grid, blower(s), and condenser. The entire site would be heated to a minimum temperature of 90 °C. Soil vapor would be extracted and treated as discussed in Section 3.3.7. Condensate would be collected, treated as necessary, and discharged to the POTW under a discharge agreement. CH2M would obtain written authorization from the City of Depew to discharge to the POTW prior to implementation. In the event that treated water cannot be discharged to the POTW, then transportation and disposal offsite would be implemented.

3.3.6.2 Thermal Conductive Heating

If TCH is selected as the remedial technology, the system would consist of heater borings/wells spaced between 15 and 20 feet apart. Each heater boring would have a heater element inside it controlled by thermostats to deliver a uniform wattage of heating across the target depth interval. Though the entire site would be heated to a minimum temperature of 90 °C, the TCH system would achieve higher temperatures near the heater wells (within 1 to 2 feet). The thermal conduction heaters would extend about 4 feet deeper than the target treatment depth to allow for some heat losses without sacrificing the achieved temperatures in the target volume.

The primary utility requirement would be electrical power (480-volt, 3-phase), a transformer to deliver power to the electrical circuits, and a power distribution system. The power would be supplied by one or more transformers connected to the higher voltage electrical grid near the site.

3.3.7 Vapor Recovery and Conveyance Piping

A vapor recovery system will be used to capture and treat contaminant vapor extracted from the subsurface. There are a range of extraction strategies employed by thermal treatment vendors, which may include multi-phase extraction wells, vapor-only extraction, and combined heating and extraction methods. The type of extraction approach implemented will be controlled by the heating technology selected, and details of recovery system construction will be developed in subsequent phases of the remedial design.

In general, fluid (vapor or liquid recovery) extraction wells applied during ISTT are constructed using 2- or 4-inch-nominal-diameter casing with wire-wrapped stainless-steel screen. The annular space will be filled with well material consisting of sand and sealed with materials capable of withstanding elevated treatment temperatures. A 2-foot-thick seal of high-temperature grout (for example, Type H cement) with 30 percent silica flour is typical.

Conveyance piping will be routed from fluid extraction points to common collection headers, which will convey extracted fluids to a central treatment location. Wellhead controls and instrumentation will be integrated in the detailed design stages such that operation of each extraction point can be monitored and system performance optimized. Given the short duration of ISTT system operation, conveyance piping will be installed on temporary support structures placed on grade. Conveyance piping will be insulated where needed to protect site workers from incidental contact and reduce heat loss in recirculated water. Shields and/or exclusion areas may also be used for worker protection.

3.3.8 Treatment System

Extracted fluids will be treated onsite. Although site-specific equipment varies by heating approach, the treatment system is expected to contain the following equipment: conveyance piping, primary heat exchanger and vapor condenser, a vapor liquid separator, and the vapor recovery blower(s). The blower(s) will be sized to capture vapors generated by the ISTT system, with adequate vacuum requirements to account for the pressure loss across the vapor treatment system and the conveyance piping. The estimated

vapor flow rate will vary depending on the kind of ISTT used; however, for the purposes of this RAWP, a flow rate of up to 500 standard cubic feet per minute is anticipated. The vapor treatment system will likely consist of thermal oxidation, catalytic oxidation, or VGAC.

Blower discharge will be routed to appropriately sized emission control equipment, which traditionally includes VGAC or thermal oxidation. In most circumstances, the expected mass recovery rate dictates the optimal vapor treatment technology. Based on the nature and extent of site contaminants, the use of VGAC is anticipated. Should detailed design calculations indicate that VGAC is not appropriate, thermal oxidation by direct, indirect, or catalytic methods would be considered. If thermal oxidation is employed, a caustic scrubber for treatment of acid gases in the oxidizer exhaust stream would be applied.

Liquid recovered through hydraulic extraction system operation or by the condensation of extracted vapors is collected and commonly treated onsite using VGAC. Secondary containment of treatment system equipment, storage tanks, and interconnected component piping will be provided using temporary liners, portable containment berms, or a curbed impervious work surface.

Extraction and treatment system components will be equipped with provisions for comprehensive process monitoring. Provisions for process monitoring typically include flow, temperature, pressure, and concentration. Measurements are normally made through a combination of automated instruments capable of logging and displaying data in real time or manual measurement or sensor observations. In general, ISTT vendors monitor pressure, temperature, and fluid flow, and manual measurement of extracted fluid composition (by qualitative or quantitative methods) to verify that the system is operating as designed and is in compliance with permitting requirements.

3.3.9 Vapor Cap

A vapor cap will be installed over the entire TTZ to minimize energy losses, prevent fugitive emissions from escaping the subsurface, prevent atmospheric air from being drawn into the fluid extraction system, and promote the positive drainage of rainwater away from the TTZ, which will limit the cooling effect of rainwater infiltration on the treatment volume. The vapor cap is commonly constructed using a spray-on concrete material (shotcrete) with additives as needed to reduce cracking and/or enhance its thermal properties.

3.3.10 Temperature Monitoring

In addition to subsurface heating components and fluid recovery wells, the ISTT treatment system will also include provisions for in situ measurement of temperature and pressure within and surrounding the TTZ. The monitoring systems are crucial in demonstrating that the ISTT system has achieved the target treatment temperatures within the TTZ and that control of hydraulic and pneumatic gradients are maintained during treatment.

Temperature monitoring points (TMPs) typically consist of Schedule 40 carbon steel pipe installed to the bottom of the treatment depth. The pipe will be plugged at the bottom, water-tight, and grouted into place. The temperature monitoring boreholes will be equipped with thermocouples to provide discrete temperature measurements over the entire thickness of the treatment volume. Temperature measurement at intervals of 2 to 5 feet bgs is customary. Temperature data will be acquired and recorded through a central ISTT system control computer. Real-time data display will be used to optimize heating system operation and document attainment of described in situ treatment temperatures. Subsurface pressure monitoring points will consist of Schedule 40 carbon steel pipe approximately 5 feet bgs. Installation and operation of remote subsurface pressure sensors may also be evaluated to streamline system operations and optimize process monitoring efforts.

3.4 In Situ Thermal Treatment System Operation

Temperature measurements will be recorded at the installed TMPs prior to the start of heating operations. After the vapor recovery wells are operational and pressure monitoring demonstrates vapor capture within

the TTZ, subsurface heating operations will commence. As soil temperatures increase, VOCs and water will be vaporized. System heating is based on the following:

- Heat capacity of the solids and water
- Latent heat required to vaporize a percentage of the groundwater to make steam that drives out the chemicals of concern (COCs)
- Heat losses to the environment
- Heat removed by the extraction system in the form of hot water, steam, and air
- Heating system energy input and depth interval
- Operational feedback from process monitoring systems

Once the desired subsurface temperature has been reached, generally after 60 to 90 days of operation, temperature within the TTZ will be maintained at or above the desired treatment temperature. As indicated by asymptotic temperature measurements, most of the applied energy will be used to generate steam. Concurrent with temperature monitoring efforts, the composition of extracted vapor will be measured using qualitative techniques such as a photoionization detector (PID) or by quantitative methods such as fixed laboratory analysis of process vapor samples collected by SUMMA canister. In addition, during steady-state operations, process temperatures, condensate production, groundwater chemical composition, extracted volume data, and total energy inputs will be measured and used to assess the effectiveness of ISTT system operation. The operational data will indicate if operational changes are warranted and if the RAO has been met. After achieving the target temperatures, operation of the ISTT will continue until the selected performance standard is met. During this phase, the heating system operation will be adjusted to optimize contaminant mass removal.

The specific monitoring protocol for the ISTT system will be defined during the procurement of the ISTT vendor. Preliminary approaches for each method are described in the following subsections. A summary of parameters from each matrix to be monitored is provided in Table 3-2. As stated previously, the heating system will be automated and daily data collection will be conducted remotely with dataloggers to the extent practical. Onsite data collection and sampling will be done as needed, and the frequency will depend on the selected thermal technology, as well as permitting constraints that will be determined after procurement (for example, POTW discharge).

3.4.1 In Situ Temperature Monitoring

As discussed in Section 3.3, TMPs capable of measuring soil temperature at varying depths will be distributed evenly throughout the ISTT TTZ. The ISTT subcontractor will be responsible for monitoring the soil temperatures reported from these monitoring points at a frequency sufficient to identify heating issues or irregularities. If cool zones are detected, additional power can be delivered to these zones or additional electrodes or heaters could be installed. Temperature monitoring will occur daily, at a minimum, by remote telemetry.

3.4.2 Energy Usage

In addition to subsurface temperature, energy input and energy extracted through the collection of soil vapor and groundwater from the treatment area will be evaluated to ensure that a sufficient quantity of energy was used to reach and maintain the target subsurface temperatures in the TTZ. The ISTT thermal subcontractor will be responsible for monitoring power consumption and system run time continuously using remote telemetry. Through comparison of the energy input and corresponding energy removed in extracted groundwater and vapor, an energy balance for the TTZ can be constructed.

3.4.3 Vacuum Measurements

Vacuum monitoring points (VMPs) will be distributed evenly throughout the ISTT TTZ. By establishing and monitoring subsurface pressure in the TTZ, pneumatic gradient control by the soil vapor collection system can also be demonstrated. Vacuum measurements will be recorded by the ISTT subcontractor and/or CH2M from each VMP multiple times during start-up to optimize vapor recovery system operation. Vacuum measurements from the VMPs will be recorded as-needed thereafter. Vacuum gauge readings from the vapor recovery system piping will be obtained and recorded by the ISTT subcontractor to verify maintained system performance.

3.4.4 Vapor Concentration and Flow Rate

The flow rate for extracted liquid and vapor are critical parameters for operation of the ISTT system, and the data will be automatically recorded daily throughout the entire period of ISTT system operation. The mass of COCs recovered through operation of the thermal treatment system will be tracked using both quantitative and qualitative methods as described previously.

3.4.5 Condensate Concentrations and Flow Rate

Influent and effluent condensate grab samples will be collected at a frequency determined by the discharge agreement with the City of Depew. Discharge volumes will be reported with the analytical results to the City of Depew in accordance with the terms of the discharge agreement.

3.4.6 Ambient Air Quality

In addition to remote monitoring of ambient air quality, periodic field screening for fugitive emissions by the ISTT subcontractor will be conducted using a PID throughout the ISTT treatment system. In the event that ambient air VOC concentrations are 1 part per million by volume above the baseline total VOC concentrations, formal ambient air monitoring will be performed as an interim response action, and the recovery system will be assessed and/or adjusted to optimize vapor capture.

3.4.7 Groundwater Sampling

During the gradual heating process, groundwater samples may be collected from monitoring wells located within and just outside of the ISTT TTZ. The potentiometric and geochemical data may be used by the ISTT vendor to adjust operation of the ISTT system. It is noted that once the target temperature and steady-state operation are achieved, groundwater sampling during ISTT operation is sometimes not meaningful. Either the groundwater has been driven off as steam (therefore, nothing to sample) or the COC concentrations are below detection limits because the contaminants volatilize as soon as they desorb from the soil. However, tracking the groundwater concentration (if possible) can establish temporal trends that demonstrate changes from heating operation, which cannot be demonstrated with soil sampling because soil sample locations cannot be duplicated.

3.4.8 In Situ Thermal Treatment System Performance Updates

Because the estimated duration of ISTT construction, operation, and decommissioning is expected to take approximately 9 to 12 months, CH2M will provide NYSDEC with progress updates when significant milestones are complete. The progress updates will identify the status and performance of the ISTT system and provide pertinent ISTT system data. Once diminished returns of subsurface heating are observed/detected by the ISTT thermal subcontractor during the operation state, the frequency of communications with NYSDEC may be accelerated.

3.5 In Situ Thermal Treatment System Confirmation Sampling

Process and performance monitoring data collected during ISTT system operation will be used to establish the point of diminishing returns for subsurface heating and for when confirmation samples should be collected to verify compliance with RAOs and determine when ISTT system operation should be terminated. Diminishing returns for system operation will be documented through the following observations:

- Subsurface Temperature Response—In situ thermal monitoring results will confirm that the co-boiling temperature of the target contaminants and water was reached and maintained in the treatment volume to remove the maximum practicable mass of COCs.
- **Contaminant Mass Flow Rate**—The mass flow rate of COCs extracted in soil vapor and groundwater has approached a steady state non-zero value (indicative of an asymptotic recovery rate).
- **Cumulative Energy Balance**—The energy input to the treatment areas was sufficient to achieve and maintain subsurface temperatures above the co-boiling point of the target contaminants and water within the saturated zone.
- **Overall System Performance**—The collective monitoring results for vapor concentrations, energy input, and subsurface temperature indicate that the input of additional thermal energy will not yield a significant reduction in COC mass, which may remain in soil and groundwater following completion of system operation.

Once the system operation has reached diminishing returns, heating will be suspended, and confirmation soil samples will be collected. Soil concentrations are typically the preferred indicator of ISTT effectiveness—as compared to groundwater—because at the end of the treatment process, the target treatment zone may be fully desiccated. Therefore, if the soil meets treatment objectives, the groundwater that eventually flows back into the treated area will also meet its RAOs, because the COC mass will have been removed from the soil.

Upon ISTT vendor notification that system operation has reached diminishing returns, CH2M will advance subsurface borings and collect treatment verification soil samples in the target treatment area. Boring location will be selected by CH2M using a 20-foot grid spacing (9 locations) with two sample intervals per location (18 total samples). Soil samples will be collected at the onset of the cool-down phase, capped, cooled, and then shipped to a laboratory for analysis. The hot soil sampling method that was validated during the Cape Canaveral demonstration project will be used (Gaberell et al. 2002, provided as Appendix C), or a similar method may be proposed by the ISTT vendors for consideration during procurement.

A 48-hour turnaround time will be requested for soil samples collected to verify system performance. Performance standards will be considered met if the 18 samples are below the New York State Brownfield Cleanup Program–Unrestricted Use Soil Cleanup Objective values (NYSDEC and New York State Department of Health, 2006) divided by 10 as summarized in Table 3-3. If confirmation sampling results demonstrate that soil performance standards were not achieved, the ISTT system will continue to operate until performance standards are fulfilled and documented by CH2M verification sampling.

Upon demonstration of remedial goal attainment, heating system infrastructure will be shut down. Operation of the vapor extraction system will continue through the confirmation sampling and analysis period, and for a brief duration after the heating system shutdown (about 2 weeks) to promote initial cool-down and removal of energy below conditions where steam formation would be favored. Subsurface thermocouples will remain in place so that temperature can be monitored during this phase.

3.6 In Situ Thermal Treatment System Decommission and Site Restoration

After the remedial goals have been achieved and demonstrated to project stakeholders, the system will be decommissioned and demobilized. During demobilization, temporary facilities, utilities, and equipment will be removed from the site. Debris or solid waste material remaining from the remedial activities will be removed and properly disposed. The heater wells/electrodes, vapor recovery wells, and conduits will either be removed or abandoned in place in accordance with the NYSDEC monitoring well decommissioning procedure selection flow chart (NYSDEC 2009). The site will be restored to preconstruction conditions. Photographs and field documents detailing site restoration activities will be prepared and submitted with the FER.

3.7 Environmental Management

RA activities will be completed in accordance with the environmental management plan (EMP) provided in Appendix D. Chemicals and/or materials that are brought onsite during construction, operation, and/or decommission phase of the ISTT system that are regulated by local, state, or federal agencies will be tracked, monitored, used, and properly disposed of, after use is complete, in accordance with the EMP and their respective safety data sheets. Waste generated during RA activities will be handled in accordance with Subsection 3.7.2 and the EMP.

3.7.1 Environmental Compliance Plans

A waste management and spill prevention control plan have been included in the EMP. Because the land disturbance of the TTZ area is less than 1 acre and the only intrusive activities will be the installation of underground heating components, an erosion and sediment control plan and a stormwater pollution prevention plan are not anticipated to be necessary for the execution of the RA activities; however, if CH2M and the selected ISTT subcontractor decide that either of these plans is necessary, then the EMP will be updated during the procurement and final design stage.

To ensure the safety of the surrounding community during construction and operation of the ISTT system, air and dust monitoring will be performed in accordance with the New York State Department of Health Generic Community Air Monitoring Plan and the Fugitive Dust and Particulate Monitoring Plan, which are provided as Appendix E.

3.7.2 Waste Management

Waste will be generated during construction, operation, and decommission of the ISTT system. Waste generated during this work will be managed and disposed of in accordance with the EMP. As needed, separate waste characterization samples will be collected and analyzed for both solid and aqueous waste. CH2M will coordinate and supervise waste profiling, manifesting, and offsite disposal at an approved disposal facility.

Because treatment of the COC-impacted media will be performed in situ, the construction of a large-scale decontamination pad will not be required for the RA activities identified in this RAWP; however, a small-scale temporary decontamination pad will be constructed to decontaminate downhole equipment used during well/boring installation and well/boring abandonment. Waste generated during well/boring installation and well/boring abandonment will be properly containerized and staged onsite in new, labeled 55-gallon steel drums that meet United Nations-specifications as required by Department of Transportation regulations. Waste drums will be placed in designated staging area prior to offsite disposal.

As described previously, waste may also be generated during operation of ancillary extraction and treatment equipment associated with the ISTT system. If activated carbon is used as part of the vapor- or liquid-phase treatment systems, samples will be collected from the inlet and outlet of the vessel to determine when the

bed is exhausted. As needed, spent carbon will be replaced with new activated carbon during operation of the ISTT system. Spent carbon will be staged in the designated waste staging area prior to offsite disposal or regeneration.

General waste and discarded personal protective equipment generated during ISTT system construction or operation will be placed in trash bags in the onsite dumpster, which will be emptied at a frequency determined by the rate of generation.

3.8 Final Engineering Report

Following completion of the RA at the site, a FER will be prepared that will discuss the specifics of the RA activities performed at the site. A narrative of remedial activities completed, as-built construction drawings, design changes and deviations, laboratory analyses, performance testing results, and quality control documentation will be included in the report. Additional information such as daily inspections/field reports, waste characterization and disposal documentation, photographs, and monitoring data will be appended as appropriate. A discussion regarding the removal of certain components of the deed restrictions will be included at the conclusion of the FER. The FER will be submitted to NYSDEC and certified by a professional engineer licensed in New York State that the remedial activities have been performed in compliance with the RAWP and the voluntary cleanup agreement.

3.9 Remedial Action Schedule

Remediation of the VOC-impacted groundwater will be initiated only after STC and Dow receive approval of the RAWP by NYSDEC and an ISTT subcontractor has been identified, selected, and procured. The following is the proposed project milestone schedule for the completion of the proposed RA activities:

- STC and Dow submit RAWP to NYSDEC—early August 2015
- STC and Dow receive NYSDEC approval of RAWP—mid-August 2015
- CH2M awards contract to selected ISTT thermal subcontractor—mid-August 2015
- ISTT thermal subcontractor completes final system design—late September 2015
- NYSDEC distributes fact sheet to near-by residents regarding upcoming RA—early October 2015
- CH2M and ISTT subcontractor construct ISTT System—early October to late November 2015
- ISTT subcontractor operates and monitors ISTT system—early December 2015 to August 2016
- ISTT subcontractor performs confirmation sampling—August 2016
- CH2M and ISTT subcontractor decommission ISTT system—September 2016
- CH2M prepares FER— October 2016
- STC and Dow submit FER to NYSDEC—November 2016
- STC and Dow receive NYSDEC approval—December 2016

Refinements to the proposed project milestone schedule provided above are likely due to the availability of the selected thermal subcontractor, availability of necessary ISTT system components, delays attributed to weather (that is, severe winter conditions), and state agency approval of site documents. Significant modifications to the proposed project milestone schedule included in the RAWP will be communicated to NYSDEC in a timely manner, as necessary.

References

CH2M HILL (CH2M). 2014. Periodic Review Report (July 7, 2013, through July 7, 2014). Former Dowell Depew Facility 3311 Walden Avenue, Depew, New York. August.

Gaberell, M., A. Gavaskar, E. Drescher, J. Sminchak, L. Cumming, W-S. Yoon, and S. De Silva. 2002. *Soil Core Characterization Strategy at DNAPL Sites Subjected to Strong Thermal or Chemical Remediation*. Paper 1E-07, in: A. R. Gavaskar and A.S.C. Chen (Eds.), Remediation of Chlorinated and Recalcitrant Compounds.

Geraghty & Miller. 1990. Site Investigation Report. Former Dowell Facility 3311 Walden Avenue Depew New York, Depew, New York.

New York State Department of Environmental Conservation (NYSDEC). 2009. DEC Program Policy CP-43/Groundwater Monitoring Well Decommissioning Policy. November.

New York State Department of Environmental Conservation (NYSDEC). 2010. DEC Program Policy DER-10/Technical Guidance for Site Investigation and Remediation. May.

URS Corporation. 2003. *Remedial Action Work Plan for the Former Dowell Facility 3311 Walden Avenue Depew, New York*. May

URS Corporation. 2004. *Remedial Action Report for the Former Dowell Facility 3311 Walden Avenue Depew, New York*. July.

URS Corporation. 2010. *Supplemental Remedial Action Report for the Former Dowell Facility 3311 Walden Avenue Depew, New York*. September.

URS Corporation. 2011. *Site Management Plan for the Former Dowell Facility 3311 Walden Avenue Depew, New York*. May.

URS Corporation. 2013. *Periodic Review Report (December 7, 2011 – July 7, 2013)*. *Former Dowell Facility 3311 Walden Avenue, Depew, New York*. August.

Tables

Table 2-1. Chronology of Site Investigations and Remedial Actions

Remedial Action Work Plan

Former Dowell Depew Facility, Depew, New York

Date	Work Performed				
September 1989	Removal and offsite disposal of the 1,000-gallon UST and its associated dispenser, the 8,000-				
	gallon AST, and contaminated soils.				
May 1990	Site investigation performed to determine the presence or absence of chemical constituents in site soil and groundwater. Low-level VOC concentrations were detected in shallow groundwater.				
January 1992	Physical/chemical evaluation of groundwater performed at former UST location. No contamination was detected in the groundwater sample.				
September 1996 - March 1997	Monitoring well installation (MW-01, MW-02, MW-03, and MW-04) and sampling VOC concentrations exceeded SCG values at MW-03 and lead exceeded the MCL at MW-02 and MW-04. The mud separator was decommissioned.				
November 1997	Supplemental investigation was performed, soil samples were collected, and groundwater samples were collected from existing monitoring wells.				
July 1998	Removal and offsite disposal of former acid plant concrete revetment, 500 tons of VOC- contaminated soil from around the acid plant, cement bulk plant debris, and other miscellaneous debris.				
July 1998 - January 2000	Groundwater samples were collected four times during this period from MW-01 through MW-04 for VOCs.				
February 26, 2001	The volunteers entered into a Voluntary Cleanup Agreement with NYSDEC.				
July 2001	Site investigation was performed to collect soil, sediment, and groundwater samples. Hydraulic conductivity testing was performed. An asbestos survey and land survey of investigation locations was completed.				
October 2003 - May 2004	Remedial activities, including asbestos abatement, building/structure demolition, monitoring well abandonment and installation, excavation and offsite disposal of approximately 4,610 tons of VOC contaminated soil.				
October 2005	Installation of monitoring well MW-07D.				
April 2008	Offsite groundwater investigation completed.				
June 2009	Installation and implementation of six injection wells upgradient of monitoring wells MW-06S and MW-06D. 377 gallons of hydrogen peroxide and sodium persulfate was injected between August and November 2009.				
September 2010	Final remedial action report was prepared and submitted to NYSDEC.				
May 2011	A site management plan was submitted to NYSDEC.				
December 2011	NYSDEC issued a Certificate of Completion for the site remediation.				
August 2013	First Periodic Review Report was submitted and presented a summary of the remedy performance during the period of December 7, 2011, through July 7, 2013.				
August 2014	Second Periodic Review Report was submitted and presented a summary of the remedy performance during the period of July 7, 2013 through July 7, 2014.				
January and April 2015	Groundwater Target Treatment Zone Investigation.				
July 2015	Third Periodic Review Report was submitted and presented a summary of the remedy performance during the period of July 7, 2014 through July 7, 2015.				

Notes:

AST = above ground storage tank

MCL = maximum contaminant level

NYSDEC = New York State Department of Environmental Conservation

SCG = applicable standards, criteria, and guidelines

UST = underground storage tank

VOC = volatile organic compound

Table 2-2. Groundwater Elevation Measurements

Remedial Action Work Plan

Former Dowell Depew Facility, Depew	New Yor	ck
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Surface Casing Depth to Total Depth Depth to Water	Groundwater Elevation June
	Flevation lune
Elevation Elevation Depth to Top Bottom of Measured Measured	
Northing Easting (U.S. survey (U.S. survey Total Depth of Screen Screen June 10, 2014 June 10, 2014	10, 2014
Well ID (feet) ^a (feet) ^b feet) ^b feet) ^b (ft btoc) (ft bgs) (ft bgs) (ft btoc) (ft btoc)	(ft)
MW-01 1060918.910 1118926.532 680.66 680.38 29.72 20 30 28.75 12.15	668.23
MW-02 1061207.358 1119169.445 679.10 678.83 28.03 18.3 28.3 26.55 3.24	675.59
MW-04 1061182.237 1119049.105 678.14 677.71 27.57 18 28 27.68 4.14	673.57
MW-06S 1061160.411 1118936.396 677.54 677.13 20.09 10 20 19.87 2.02	675.11
MW-06D 1061162.079 1118940.064 677.45 677.16 30.21 20 30 29.60 2.03	675.13
MW-07S 1061150.146 1118858.431 677.17 676.66 19.49 9.5 19.5 18.97 3.84	672.82
MW-07D 1061142.027 1118861.752 677.43 676.83 29.90 20 30 30.19 4.78	672.05
RW-01 1061164.035 1118969.498 677.76 680.34 18.58 6 16 18.50 3.08	677.26
RW-02 1061102.659 1119042.870 678.66 681.16 18.50 6 16 18.05 3.85	677.31
PZ-01S 1061010.277 1118925.124 678.44 681.49 15.05 2 12 15.10 5.20	676.29
PZ-01D 1061004.001 1118926.203 678.86 681.88 27.52 22.5 24.5 27.07 5.28	676.60
PZ-02S 1060920.110 1118923.845 680.72 684.53 15.81 10 12 16.50 4.91	679.62
PZ-03S 1061038.815 1119046.902 680.09 683.08 14.99 10 12 15.02 3.95	679.13
PZ-03D 1061043.063 1119052.978 680.38 682.60 26.22 22 24 26.97 3.49	679.11
PZ-04S 1061069.999 1118915.093 678.23 681.23 15.00 10 12 15.10 6.49	674.74
PZ-04D 1061074.170 1118919.821 678.24 681.44 27.70 22.5 24.5 27.09 6.52	674.92
PZ-05S 1061114.176 1119128.343 679.56 682.19 14.63 10 12 15.00 3.80	678.39
PZ-05D 1061117.993 1119132.212 679.53 682.85 27.62 22.3 24.3 26.70 4.75	678.10
PZ-07S 1061161.630 1119094.894 679.01 681.93 15.42 10.5 12.5 14.78 4.90	677.03
PZ-07D 1061164.545 1119103.472 679.01 681.91 27.90 23 25 27.05 4.84	677.07
PZ-08S 1061181.135 1119044.411 678.25 681.90 15.45 9.8 11.8 15.00 5.25	676.65
<u>PZ-09S 1061202.304 1119170.928 679.21 683.16 16.25 10.3 12.3 15.02 5.89</u>	677.27

^a North American Datum of 1983 (2011), New York State Plane Coordinate System (West Zone), United States survey feet.

^bNorth American Vertical Datum of 1988, United States survey feet.

Notes:

ft = feet

ft bgs = feet below ground surface ft btoc = feet below top of casing

MW = monitoring well PZ = piezometer

Table 2-3. Detected Analytes in Groundwater – June 2014

Remedial Action Work Plan

Former Dowell Depew Facility, Depew, New York

	Location	MW-06D	MW-06S	MW-07D	MW-07S	RW-01
	Sample ID	MW-6D-061014	MW-6S-061014	MW-7D-061014	MW-7S-061014	RW-01-061014
	Sample Date	6/10/2014	6/10/2014	6/10/2014	6/10/2014	6/10/2014
Analyte	SCG Values					
VOC (µg/L)						
1,1,1-Trichloroethane	5	158 J	7.77	0.82 U	0.82 U	0.82 U
1,1-Dichloroethane	5	11800	252	0.38 U	0.38 U	0.715 J
1,1-Dichloroethene	5	25.7	4.82	0.29 U	0.29 U	0.29 U
1,2-Dichloroethane	0.6	2.72	0.21 U	0.21 U	0.21 U	0.21 U
1,2-Dichloroethene, Total	5*	11.1	1.46 J	0.81 U	0.81 U	3.92
Chloroethane	5	568 J	13.9 J	0.32 UJ	0.32 UJ	0.32 UJ
cis-1,2-Dichloroethene	5	11.1	1.46	0.81 U	0.81 U	3.92
Methyl tert-butyl ether	10	0.687 J	0.16 U	0.16 U	0.16 U	0.16 U
Trichloroethene	5	0.46 U	0.503 J	0.46 U	0.46 U	0.46 U
Vinyl Chloride	2	4.77	0.9 U	0.9 U	0.9 U	0.9 U

Notes:

SCG Values = Applicable standards, criteria, and guideline values. Division of Water Technical & Operational Guidance Series (TOGS) 1.1.1 New York State

Ambient Water Quality Standards and Guidance Values and Ground Water Effluent Limitations

- Table 1 and Table 5 - Class GA; June 1998; modified January 1999; modified April 2000; modified June 2004

*Screening level for cis-1,2-Dichloroethene used for total 1,2-Dichloroethene.

Bold indicates that the analyte was detected.

Grey shading indicates that the result exceeded the screening level.

 μ g/L = micrograms per liter

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample

U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of

quantitation necessary to accurately and precisely measure the analyte in the sample.

VOC = volatile organic compound

Table 3-1. Engineer Estimate of Contaminant Mass In Target Treatment Zone

Remedial Action Work Plan Former Dowell Depew Facility, Depew, New York

A. Groundwater Concentration Data (see notes 1 through 3)

	Contaminant Concentration (µg/L)					
Well ID	1,1-DCA	Chloroethane	1,1,1-TCA			
TW-03S	11,900	4,750	17.6			
TW-05S	169	1	136			
TW-11S	0.693	1	1			
TW-01S	41.8	1	209			
TW-13S	1	1	1			
TW-06S	3.75	1	2.17			
TW-12S	1,010	5.4	516			
Average	1,875	680	126			
Maximum	11,900	4,750	516			

B. Site Data (see notes 4 and 5)

Parameter	Value	Unit	Comment
Top of Treatment	3	ft bgs	Depth to groundwater within TTZ
Interval			
Bottom of Treatment	30	ft bgs	Based on TTZ Investigation (CH2M - July 2015)
Interval			
Aquifer Porosity	0.25		Assumed value
Treatment Area	3,400	ft ²	Based on TTZ Investigation (CH2M - July 2015)
Soil Density	49.9	kg/ft ³	Assumed value of 110 lb/cf
K _{oc} of 1,1-DCA	3.02E+01	L/kg	ATSDR, 2013
K_{oc} of Chloroethane	1.43E+02	L/kg	ATSDR, 1998
K _{oc} of 1,1,1-TCA	1.05E+02	L/kg	ATSDR, 2006
f _{oc}	0.0028		Average of TestAmerica 01/28/2015 site analytical data

C. Estimate of COC Mass (see note 6)

	Concentration		Mas	Mass		Mass	
	in GW (µg/L)	in Soil (µg/kg)	in GW (g)	in Soil (g)	in GW (lb)	in Soil (lb)	Mass (lb)
			1,1-I	DCA			
Average	1,875	159	1,218	730	3	2	4
Maximum	11,900	1,011	7,732	4,631	17	10	27
		Chlore					
Average	680	273	442	1,253	1	3	4
Maximum	4,750	1,911	3,086	8,753	7	19	26
	1,1,1-TCA						
Average	126	37	82	170	0	0	1
Maximum	516	152	335	696	1	2	2
	TOTAL						
Average			1,742	2,152	4	5	9
Maximum			11,154	14,080	25	31	56

Notes

1) Groundwater concentration data from January and April 2015 sampling events which were performed to delineate the TTZ.

2) Calculations include the three predominant contaminants of concern: 1,1-DCA, chloroethane, and 1,1,1-TCA. Contribution to total mass from remaining COCs is negligible.

3) The laboratory reporting limit was used where the contaminant was not detected.

4) The delineation of the TTZ is described in detail in the July 2015 Target Treatment Zone Investigation Technical Memorandum.

5) K_{oc} values taken from the pertinent ToxGuides published by the Agency for Toxic Substances and Disease Registry.

6) Equilibrium calculations to estimate mass in soil using groundwater data performed as follows: X (conc. in soil) = $K_{\infty} * f_{\infty} * C$

Acronyms

μg/L	micrograms per liter
1,1-DCA	1,1-dichloroethane
1,1,1-TCA	1,1,1-trichloroethane
ft bgs	feet below ground surface
ft ²	square feet
kg/ft ³	kilograms per cubic feet
L/kg	liters per kilogram
K _{oc}	organic carbon water partition coefficient
f _{oc}	fraction of organic carbon
ATSDR	Agency for Toxic Substances and Disease Registry
TTZ	target treatment zone
g	grams
lb	pounds
µg/kg	micrograms per kilogram

Table 3-2. Conceptual Monitoring Parameter Summary for ISTT

Remedial Action Work Plan

Former Dowell Depew Facility, Depew, New York

Media	Monitored activity	Data Use	Monitoring location	Analyte	Monitoring Type/Method	Typical Monitoring Frequency		
Vapor	VOC mass removal	Determine point of diminishing returns for	Vapor treatment influent header	VOCs	Grab sample (PID/FID and	Variable: daily, weekly, or monthly depending on		
		system shutdown; operational decisions.			SUMMA [TO-15])	observations and data needs		
	Vacuum extraction monitoring	Verify vapor control.	VMPs	Pressure (negative)	Pressure gauge	Variable: daily to weekly		
	Treatment system off-gas	Verify compliance with permit(s); operational	Discharge stack	VOCs and other constituents required	Grab sample	As required by permit; more frequently at		
		decisions.		by the air permit		startup; daily to weekly during operations		
	Ambient air	Assess outdoor air quality within and downwing	d Various locations around the ISTT	VOCs	PID/FID	Variable: daily to weekly		
		of the ISTT TTZ.	area					
Condensate	VOC mass removal	Determine point of diminishing returns for	Condensate collection system	1. VOCs	1. Grab Samples	Variable: weekly to monthly		
		system shutdown; operational decisions; verify		2. Flow Rate	2. Meter with Totalizer			
		compliance with discharge agreement.						
Groundwater	Potentiometric surface	Verify groundwater contaminant migration	Monitoring wells outside the TTZ	Piezometric levels	Water level indicator	Variable: weekly to monthly		
		control.			transducers			
	Groundwater chemistry	Operational decisions	Monitoring wells within the TTZ	1. DO, ORP	1. Direct Reading Field	Baseline		
					Instrument			
				2. Nitrate	2. EPA 353.2			
				3. Ferrous Iron	3. Field Kit			
				4. Sulfate & Chloride	4. EPA 300			
				5. Alkalinity	5. EPA 310.1 or HACH			
					Alkalinity Test Kit			
				6. Cations (Ca, Mg, K, Na, Mn)	6. EPA 6010B			
	VOC mass	Operational decisions; permitting compliance	Monitoring wells within the TTZ	1. CVOCs	1. Grab Sample			
Soil	Temperature	Assess heating goals.	TMPs	Temperature	Thermocouples, Fiber Optic	Variable: daily to weekly		
					DTS			
	VOC mass removal	Establish a basis for evaluating remedy	Multiple baseline and post-	CVOC concentrations	Grab Soil Samples	Baseline then when mass removal levels become		
		effectiveness, estimate the amount of VOC	treatment sample locations			asymptotic		
		mass in the TTZ, and confirm the						
		appropriateness of the air pollution control						
		technology.						
Utilities	Electrical use	Fees and operational decisions	Main Electrical Drop	Kilowatts	Meter	Daily		
Notes:								
CVOC = chlori	CVOC = chlorinated volatile organic compound							
DO = dissolved	d oxygen							
DTS = distribu	ted temperature sensing							
FID = flame io	nization detector							
ISTT = in situ t	hermal treatment							

ORP = oxidation reduction potential

PID = photoionization detector

TMP = temperature monitoring point

TTZ = target treatment zone

VMP = vapor/vacuum monitoring points

VOC = volatile organic compounds

1. This table represents a conceptual approach of parameters monitored during ISTT operations. Adjustments to the monitoring parameters will be made during the design process.

Table 3-3. Performance Standards

Remedial Action Work Plan Former Dowell Depew Facility, Depew, New York

Contaminant of Concern	Performance Standard in Soil ^a		Maximum Historical Detection in Groundwater		
	Value	Units	Value	Units	Well ID
1,1,1-Trichloroethane	68	µg/kg	516	μg/L	TW-12S
1,1-Dichloroethane	27	µg/kg	11900	μg/L	TW-03S
1,1-Dichloroethene	33	µg/kg	75.7	μg/L	TW-01S
1,2-Dichloroethane	2	µg/kg	3.57	μg/L	TW-03S
1,2-Dichloroethene (Total) ^b	25	μg/kg	77.1	μg/L	TW-11D
Benzene	6	µg/kg	1.62	μg/L	TW-04D
Chloroethane ^c	70	μg/kg	4750	μg/L	TW-03S
cis-1,2-Dichloroethene	25	µg/kg	75.1	μg/L	TW-11D
Ethylbenzene	100	µg/kg	31.5	μg/L	TW-04D
Tetrachloroethene	130	µg/kg	28.4	μg/L	TW-12S
Trichloroethene	47	µg/kg	7.7	μg/L	TW-15S
Vinyl Chloride	2	µg/kg	5.8	μg/L	TW-11D
Xylenes, Total	26	μg/kg	179	μg/L	TW-04D

Notes:

a) Performance Standards in Soil are the New York State Brownfield Cleanup Program - Unrestricted Use Soil Cleanup Objective values divided by 10. See Table 11-1 of September 2006 publication.

b) As there is no unrestricted use value for 1,2-Dichloroethene (Total), the performance standard for cis-1,2-

Dichloroethene is used in its place.

c) As there is no unrestricted use value for chloroethane, the performance standard is calculated from equilibrium partitioning data.

µg/kg = micrograms per kilogram

 μ g/L = micrograms per liter

Figures



Remedial Action Work Plan Former Dowell Depew Facility, Depew, New York





FIGURE 2-2 Site Map Remedial Action Work Plan





ch2m



MW-02 2 PZ-09S

Notes:

- J = The analyte was positively identified, the associated numerical value is the approximate concentration.
- U = The analyte was analyzed for, but was not detected above the reported sample detection limit.

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- 3. UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- 4. ft bgs = feet below ground surface
- 5. $\mu g/L = micrograms per liter$
- 6. VOC = volatile organic compound
- 7. Bold indicates the analyte was detected
- Shading indicates that the result exceeded applicable standards, criteria, and guideline (SCG) values.
- 9. Location of former buildings, tanks, concrete, and features is approximate.

FIGURE 2-4 VOCs Exceeding SCG Values Remedial Action Work Plan Former Dowell Depew Facility, Depew, New York






FIGURE 3-2 Conceptual Process Flow Diagram for an In Situ Thermal Treatment System (Thermal Conductive Heating) Remedial Action Work Plan Former Dowell Depew Facility, Depew, New York





Former Dowell Depew Facility, Depew, New York - CH2MHILL

Appendix A Target Treatment Zone Technical Memorandum TECHNICAL MEMORANDUM



Target Treatment Zone Investigation Technical Memorandum, Former Dowell Depew Facility, Depew, New York

PREPARED FOR:	Virgilio Cocianni/Schlumberger Technology Corporation
	Jim Strunk/The Dow Chemical Company
DATE:	July 2015
PROJECT NUMBER:	480860.15.03.03

The target treatment zone (TTZ) investigation of the former Dowell Depew Facility in Depew, New York (site) was performed by CH2M HILL Engineers, Inc. (CH2M) on behalf of Schlumberger Technology Corporation (STC) and The Dow Chemical Company (Dow) under the New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Program (VCP). The site entered into the NYSDEC VCP on February 26, 2001, under Voluntary Cleanup Agreement # B9-0586-00-10, Site # V-00410-9. Dowell was a former joint venture between STC and Dow.

Overall, the TTZ investigation was designed to refine the conceptual site model of the residual onsite volatile organic compound (VOC)-impacted groundwater to help identify and design the corrective measure(s) for the site. Specifically, the TTZ investigation was completed to accomplish the following:

- Assess VOC concentrations in groundwater in the vicinity of site monitoring wells MW-06S, MW-06D and RW-01 to determine the TTZ.
- Collect geotechnical data to obtain an enhanced understanding of the subsurface characteristics to assist in the selection and design of the corrective measure.
- Collect pertinent site-specific data (for example, utility survey and topographic survey of the site) necessary for the design and construction of the corrective measure.

Site Overview

The following subsections describe the site, provide the operational history, and present a summary on the remedial actions and residual onsite contamination.

Site Description

The former Dowell Depew Facility is located at 3311 Walden Avenue in the Village of Depew, New York (Figure 1). The site is located east of Buffalo, New York, in a mixed residential and industrial/commercial area. As shown in Figure 2, properties surrounding the site include Walden Avenue to the north, a CSX railroad yard to the south, a lumber yard and supply store (84 Lumber) to the east, and a mattress manufacturer (Buffalo Batt and Felt) to the west. A residential neighborhood and a recycling facility (EnviroSense Corp.) are located adjacent to the site on the north side of Walden Avenue.

The site covers approximately 1.8 acres and is relatively flat with a gentle downward slope to the north– northwest toward Walden Avenue. Maximum relief across the site (that is, from south to north) is about 4 feet, and surface water flows from south to north across the site. The property is currently vacant, and the ground surface consists primarily of gravel and grass with small- to medium-sized trees on portions of the site. A 6-foot-high chain-linked fence with a locked entrance gate along Walden Avenue surrounds the site.

Site Operational History

Former activities at the site included servicing industrial facilities and limited oilfield-related projects. Various industrial cleaning and oilfield-related chemicals were stored onsite and transferred into tank trucks for use at different job sites (URS Corporation [URS] 2004). A former railroad siding, which has since been removed, traversed the site from east to west. Former onsite building structures included the following: a two-story office building, a chemical storage building, a one-story office/maintenance shop, an acid plant, a bulk cement plant, cement silos, an 8,000-gallon diesel aboveground storage tank (AST), a 1,000-gallon gasoline underground storage tank (UST) with dispenser, a mud separator, an oil/water separator, and a hydrochloric acid AST (Figure 2). In the late 1980s, operations at the site were discontinued, and the facility was permanently closed. Building structures were razed during the 2003 to 2004 remedial action (RA), and the site has since been inactive (URS 2011).

Summary of Remedial Actions and Residual Site Contamination

Several site investigations and RAs were performed after site operations were discontinued. A chronology of the site investigations and RAs is presented in Table 1.

Through excavation activities, VOC-contaminated soil at the site has been remediated for restricted commercial use. Institutional controls are in place to prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination and by limiting the use and development of the site to commercial uses only. Residual soil contamination was not addressed as part of the TTZ investigation, and will not be discussed further. Additional information on the soil RA is presented in the *Remedial Action Report for the Former Dowell Facility* (URS 2004).

The chemicals of concern in groundwater are VOCs, primarily 1,1-dichloroethane (1,1 DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), 1,1,1-trichloroethane (1,1,1-TCA), chloroethane, and vinyl chloride. Following the completion of the 2004 RA, a long-term groundwater monitoring program was implemented to monitor VOC-impacted groundwater. Groundwater samples were collected from site monitoring wells quarterly from July 2004 to December 2009 and from September 2011 to July 2013. After the completion of the July 2013 sampling event, the long-term groundwater monitoring program was modified. The sampling frequency was reduced from quarterly to annual sampling, and the monitoring well network was reduced to the sampling of site monitoring wells MW-06S, MW-06D, RW-01, MW-07S, and MW-07D. As of the last annual groundwater sampling event, conducted in June 2014, analysis of data indicated that the residual groundwater contamination exceeding applicable standards, criteria, and guidelines (SCGs) values onsite is still limited to the area around site monitoring wells MW-06S, MW-06D, and RW-01.

Target Treatment Zone Investigation

TTZ investigation activities were conducted in late January and early April 2015. Thirty-two temporary monitoring wells were drilled and constructed to obtain groundwater grab samples to assess the extent of the residual VOC-impacted groundwater plume.

Utility Locate and Topographic Survey of the TTZ

Prior to conducting intrusive work, the New York "Dig Safely New York" number was called to clear proposed soil boring/temporary well locations. A third-party utility survey was performed by Bloodhound Underground Utility Locators during both field mobilizations. The utility locate performed during the April 2015 field event was deemed necessary because the area of interest had increased since the previous utility survey was performed and because utility locating and marking of the entire site was necessary for the completion of a topographic survey of the site.

A topographic survey of the site and site features was conducted during the April 2015 field event to support the design and construction of the selected corrective measure. The topographic survey consisted of collecting ground surface elevations (on a 20-foot grid pattern) of the entire site and identifying site

features such as above- and belowground utilities and fence lines. Surveying activities also included verifying and/or establishing ground surface elevations, top of casing elevations, and horizontal and vertical coordinates of existing site monitoring wells, injection wells, piezometers, and temporary wells.

The survey fieldwork was performed by Thew Associates under the direct supervision of a State of New York Professional Land Surveyor. The survey was completed using static global positioning system instruments aligned to the New York State Plane Coordinate System, North American Datum of 1983, West Zone, and the North American Vertical Datum of 1988, respectively. Elevations were recorded in United States survey feet. The survey coordinates of the temporary wells constructed during the TTZ investigation are presented in Table 2, and the topographic survey map is provided as Attachment 1.

Soil Boring and Temporary Well Construction

CH2M contracted Parratt-Wolff to drill and construct 32 temporary wells to assess VOC concentrations in groundwater in the vicinity of site monitoring wells MW-06S, MW-06D, and RW-01. Sixteen soil borings/temporary wells were advanced and constructed in late January/early February 2015, and an additional 16 soil borings/temporary wells were advanced and constructed in early April 2015. Soil boring/temporary well locations are shown in Figure 3. In general, two soil borings, a shallow and a deep, were advanced at each location to collect discrete groundwater samples. Shallow soil borings were advanced to a depth of approximately 20 feet below ground surface (bgs), and deep soil borings were advanced to a depth of approximately 30 feet bgs.

With the exception of soil boring/temporary well locations TW-08D,TW-09D, TW-16S, and TW-17S, which were advanced blindly due to time constraints, soil samples were retrieved from each soil boring location using a 4-foot macrocore sampler with acetate sample liners. Upon retrieval from the boring, the soil sample was removed from the sampler, screened with a photoionization detector (PID), visually inspected to identify the presence of staining or groundwater, and logged to describe the stratigraphy. After the sample was inspected and logged, a small portion of the sample was placed in a plastic bag for organic vapor screening headspace sample analysis. The plastic bag was sealed and allowed to equilibrate to ambient temperatures for approximately 15 minutes prior to taking a reading using the PID. The PID reading, along with a lithologic description of each sample, was recorded on the soil boring log. The lithologic logs are provided as Attachment 2.

At each soil boring location, a temporary well was constructed so that a groundwater grab sample could be collected for VOC analysis. Each temporary well consisted of a 1-inch-diameter, 5-foot-long polyvinyl chloride well screen and riser. Well screens for the shallow groundwater grab sample locations were set at a depth interval of approximately 15 to 20 feet bgs and for the deep groundwater grab sample locations, well screens were set at an approximate depth of 25 to 30 feet bgs. Temporary monitoring well surface completions were not constructed because temporary monitoring wells were abandoned immediately after groundwater grab sample collection.

Geotechnical Soil Sample Collection

During the January 2015 field event, two geotechnical borings (GTECH-01 and GTECH-02) were advanced to evaluate the geotechnical and hydraulic properties of the TTZ. The location of the geotechnical borings are presented in Figure 3. Three disturbed geotechnical soil samples were collected from soil boring GTECH-01 at depths of 1 to 3, 15 to 17, and 22 to 24 feet bgs for grain size analysis using ASTM International method D422, total organic carbon analysis using the U.S. Environmental Protection Agency Lloyd Kahn analytical method, pH analysis using analytical method SW846 9045D, and iron and manganese analysis using analytical method SW846 6010C.

Two undisturbed soil samples were collected from soil boring GTECH-02 at depths of 15 to 17 and 22 to 24 feet bgs for hydraulic conductivity analysis using ASTM International method D5084 and porosity analysis using ASTM International method D7263. After sample collection, the disturbed geotechnical soil samples were sent to TestAmerica Laboratories, Inc. (TestAmerica), and the undisturbed geotechnical soil samples

were sent to GeoTesting Express for geotechnical analysis. Table 3 presents the geotechnical and hydraulic properties of soil borings GTECH-01 and GTECH-02. The geotechnical laboratory reports are presented in Attachment 3.

Groundwater Sample Collection from Temporary Wells

Once a sufficient volume of water entered into the well, groundwater grab samples were collected from each temporary well using single-use disposable bailers. After sample collection, each groundwater grab sample was placed on ice and hand delivered to TestAmerica in Buffalo, New York. Groundwater grab samples were analyzed by TestAmerica for VOCs analysis using analytical method 8260C. Following groundwater grab sample collection, each temporary well was removed and the open boring was abandoned in accordance with New York State Regulations.

Nature and Extent of VOCs in Groundwater

Table 4 presents the VOC analytes that were detected in shallow and deep groundwater units during the January and April 2015 TTZ investigations. Figures 4 and 5 present VOC analytes¹ that exceeded SCG values in at least two temporary monitoring well locations in shallow and deep groundwater units, respectively. Laboratory reports from TestAmerica are presented in Attachment 4.

Twenty-five VOCs were detected and 14 VOCs exceeded SCG values at one or more temporary well locations. VOCs that exceeded applicable SCG values are 1,1,1-TCA, 1,1-DCA, 1,1-DCE, 1,2-DCA, cis-1,2-DCE, total 1,2-DCE, acetone, benzene, chloroethane, ethylbenzene, tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, and total xylenes. The highest VOC concentrations were generally detected in groundwater samples collected from temporary wells in close vicinity to monitoring wells MW-06S, MW-06D, and RW-01, that is TW-01S, TW-03S, and TW-04D.

Exceptions include 1,1,1-TCA and PCE concentrations in TW-12S and cis-1,2-DCE and vinyl chloride concentrations in TW-11D. The highest 1,1,1-TCA and PCE concentrations were detected in the groundwater sample collected from temporary well TW-12S; however, groundwater samples collected from temporary well TW-14[S/D] and TW-16[S/D]) and temporary wells downgradient (TW-02[S/D] and TW-06[S/D]) of well TW-12S did not contain exceedances of 1,1,1-TCA or PCE, indicating that elevated 1,1,1-TCA and PCE concentrations are localized to the area around well TW-12S. The presence of elevated levels of cis-1,2-DCE (75.1 micrograms per liter [μ g/L]) in the groundwater sample collected from temporary well TW-11D was also seen in groundwater samples collected from temporary wells TW-11S and TW-15(S/D). Cis-1,2-DCE concentrations in other temporary wells are almost an order of magnitude lower, indicating that elevated cis-1,2-DCE concentration of vinyl chloride in the groundwater sample from temporary well TW-11D was the highest detected during the January and April 2015 sampling events; however, the observed concentrations of 1,1,1-TCA, PCE, and cis-1,2-DCE, the majority of the VOC mass is located in the vicinity of site monitoring wells MW-06S, MW-06D, and RW-01.

As shown in Figures 4 and 5, the TTZ has been identified based on groundwater results from the TTZ investigation. Based on the extent of SCG exceedances and the remedial action objectives, the TTZ is approximately 3,400 square feet and extends to the top of bedrock, which is 30 feet deep on average. As such, the total volume of the TTZ is estimated to be 102,000 cubic feet (or approximately 3,800 cubic yards).

The TTZ will be used as the basis for the corrective measure design, which will be submitted to NYSDEC as part of the remedial action work plan. Remediating the TTZ will deplete/eliminate the residual

¹ Even though acetone concentrations exceeded SCG values in more than one groundwater sample, acetone is not shown in Figures 4 and 5 because it is a known laboratory contaminant. Historically, acetone was not used in site operations and has not been detected in onsite monitoring wells (MW-06S and MW-06D). Therefore, acetone is not considered a site-related chemical of concern.

VOC-impacted groundwater plume, reduce long-term environmental risk, and enable the removal of some or all of the institutional controls (that is, long-term monitoring) from the property deed.

References

URS Corporation. 2004. *Remedial Action Report for the Former Dowell Facility 3311 Walden Avenue, Depew New York*. July.

URS Corporation. 2011. *Site Management Plan for the Former Dowell Facility 3311 Walden Avenue, Depew New York*. May.

Tables

Table 1. Chronology of Site Investigations and Remedial Actions

Target Treatment Zone Investigation Technical Memorandum Former Dowell Depew Facility, Depew, New York

Date	Work Performed
September 1989	Removal and offsite disposal of the 1,000-gallon UST and its associated dispenser, the 8,000-gallon AST, and contaminated soils.
May 1990	Site investigation performed to determine the presence or absence of chemical constituents in site soil and groundwater. Low-level VOC concentrations were detected in shallow groundwater.
January 1992	Physical/chemical evaluation of groundwater performed at former UST location. No contamination was detected in the groundwater sample.
September 1996 - March 1997	Monitoring well installation (MW-01, MW-02, MW-03, and MW-04) and sampling were performed. VOC concentrations exceeded SCG values at MW-03, and lead exceeded the MCL at MW-02 and MW-04. The mud separator was decommissioned.
November 1997	Supplemental investigation was performed, soil samples were collected, and groundwater samples were collected from existing monitoring wells.
July 1998	Removal and offsite disposal of former acid plant concrete revetment, 500 tons of VOC- contaminated soil from around the acid plant, cement bulk plant debris, and other miscellaneous debris.
July 1998 - January 2000	Groundwater samples were collected four times during this period from MW-01 through MW-04 for VOCs.
February 26, 2001	The volunteers entered into a Voluntary Cleanup Agreement with NYSDEC.
July 2001	Site investigation performed to collect soil, sediment, and groundwater samples. Hydraulic conductivity testing was performed. An asbestos survey and land survey of investigation locations was completed.
October 2003 - May 2004	Remedial activities, including asbestos abatement, building/structure demolition, monitoring well abandonment and installation, excavation, and offsite disposal of approximately 4,610 tons of VOC-contaminated soil.
October 2005 April 2008 June 2009	Installation of monitoring well MW-07D. Offsite groundwater investigation completed. Installation and implementation of six injection wells upgradient of monitoring wells MW-06S and MW-06D. 377 gallons of hydrogen peroxide and sodium persulfate were injected between August and November 2009.
September 2010	Final remedial action report was prepared and submitted to NYSDEC.
May 2011	A site management plan was submitted to NYSDEC.
December 2011	NYSDEC issued a Certificate of Completion for the site remediation.
August 2013	First periodic review report was submitted and presented a summary of the remedy performance during the period of December 7, 2011, through July 7, 2013.
January and April 2015	Groundwater target treatment zone investigation.

Notes:

AST = above ground storage tank

MCL = maximum contaminant level

NYSDEC = New York State Department of Environmental Conservation

SCG = applicable standards, criteria, and guidelines

UST = underground storage tank

VOC = volatile organic compound

Table 2. Temporary Well Locations and Elevations

Target Treatment Zone Investigation Technical Memorandum Former Dowell Depew Facility, Depew, New York

			Ground Surface
	Northing	Easting	Elevation
Well ID	(feet) ^a	(feet) ^b	(U.S. survey feet) ^b
RW-01D	1061168.114	1118969.465	677.56
TW-01(S/D)	1061144.585	1118936.811	677.42
TW-02(S/D)	1061151.093	1118918.266	677.45
TW-03(S/D)	1061161.347	1118962.970	677.40
TW-04D	1061167.805	1118941.220	677.40
TW-05(S/D)	1061127.576	1118941.767	677.46
TW-06(S/D)	1061158.684	1118926.406	677.42
TW-07(S/D) ^c	1061149.261	1118961.176	677.84
TW-08D	1061169.060	1118983.556	677.38
TW-09D	1061151.717	1118978.771	677.69
TW-10D	1061096.116	1118942.124	677.66
TW-10S	1061097.044	1118944.153	677.68
TW-11D	1061125.399	1118968.128	677.82
TW-11S	1061124.116	1118968.907	677.78
TW-12D	1061128.921	1118924.042	677.45
TW-12S	1061129.582	1118926.471	677.47
TW-13D	1061107.580	1118973.954	678.00
TW-13S	1061109.643	1118973.694	677.99
TW-14D	1061112.584	1118936.518	677.67
TW-14S	1061112.790	1118939.475	677.52
TW-15D	1061112.656	1118957.787	677.76
TW-15S	1061112.666	1118959.699	677.70
TW-16D	1061114.176	1118921.046	677.62
TW-16S	1061114.623	1118922.254	677.60
TW-17D	1061117.641	1118984.355	678.23
TW-17S	1061118.614	1118982.948	678.24

Notes:

^a North American Datum of 1983 (2011), New York State Plane Coordinate System (West Zone), United States survey feet.

^bNorth American Vertical Datum of 1988, United States survey feet.

^c Temporary wells were not surveyed by the surveyor. Coordinates were obtained from a handheld global positioning system unit. Elevation was inferred based on adjacent ground surface elevation.

D = deep

S = shallow

Locations were surveyed between April 1 and 3, 2015.

Table 3. Geotechnical Sample Results

Target Treatment Zone Investigation Technical Memorandum

Former Dowell Depew Facility, Depew, New York

		Grain Size					Hydraulic	
	Depth	Distribution	Total Organic Carbon		Iron	Manganese	Conductivity	
Soil Boring	(feet bgs)	(percent)	(mg/kg)	рН	(mg/kg)	(mg/kg)	(cm/s)	Porosity
		Gravel: 43.6						
GTECH-01	1 to 3	Sand: 36.8	29,700	11.0 HF	77,700 B	30,000 B		
		Fines ^a : 19.6						
		Gravel: 2.7						
GTECH-01	15 to 17	Sand: 20.5	19,800	9.11 HF	15,700 B	411 B	-	-
		Fines ^a : 76.8						
		Gravel: 26.2						
GTECH-01	22 to 24	Sand: 24.2	34,900	9.08 HF	12,200 B	308 B		
		Fines ^a : 49.6						
GTECH-02	15 to 17						6.2 x 10 ⁻⁵	0.38
GTECH-02	22 to 24						2.9 x 10 ⁻⁸	0.22

Notes:

^aFines consist of silts and clays (based on percent passing the Number 200 sieve)

-- = sample not collected

B = compound was found in the blank and sample

bgs = below ground surface

cm/s = centimeters per second

HF = field parameter with a holding time of 15 minutes. Test performed by laboratory at client's request

mg/kg = milligrams per kilogram

Table 4. Detected Analytes in Groundwater – January and April 2015

Target Treatment Zone Investigation Technical Memorandum

Former Dowell Depew Facility, Depew, New York

		Location ID:	RW-01D	TW-01D	TW-015	TW-02D	TW-02S	TW-03D	TW-03S	TW-04D	TW-05D	TW-05S	TW-06D	TW-06S	TW-07D	TW-07S	TW-08D	TW-09D
		Sample Date:	1/30/2015	1/27/2015	1/27/2015	1/27/2015	1/28/2015	1/27/2015	1/27/2015	1/30/2015	2/4/2015	2/4/2015	2/4/2015	2/4/2015	2/4/2015	2/4/2015	2/4/2015	2/4/2015
		Sample ID:	RW-01D-GW-	TW-01D-GW-	TW-01S-GW-	TW-02D-GW-	TW-02S-GW-	TW-03D-GW-	TW-03S-GW-	TW-04D-GW-	TW-05D-GW-	TW-05S-GW-	TW-06D-GW-	TW-06S-GW-	TW-07D-GW-	TW-07S-GW-	TW-08D-GW-	TW-09D-GW-
		Sample ID:	013015	012715	012715	012715	012815	012715	012715	013015	020415	020415	020415	020415	020415	020415	020415	020415
Analyte	SCG Values	Units	_															
1,1,1-Trichloroethane	5	μg/L	3.65	63.4	209	6.6	3.31	40.8	17.6	43.7	248	136	1 U	2.17	3.84	1 U	1 U	1.34
1,1-Dichloroethane	5	μg/L	652	10.7	49.3	4.19	1.73	304	11900	3330 J	297	169	0.884 J	3.75	20	2.63	3.74	10.3
1,1-Dichloroethene	5	μg/L	1.4	16.8	75.7	2.51	1.61	3.59	8.44	8.39	46.3	29.3	0.668 J	1.23	0.96 J	1 U	0.383 J	0.568 J
1,2-Dichlorobenzene	3	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U	4 U	1 U	1 U	1 U	1 U	1.01	1.13
1,2-Dichloroethane	0.6	μg/L	1 U	1 U	0.739 J	1 U	1 U	1 U	3.57	0.966 J	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (Total)	5*	μg/L	1.37 J	1.89 J	5.05	1.7 J	0.916 J	2.42	7.77	4.73	8.57 J	8.07	2 U	1.02 J	1.11 J	2 U	1.14 J	1.91 J
2-Butanone	50	μg/L	10 U	8.48 J	2.67 J	8.23 J	10 U	10 U	10 U	23.2	100 U	40 U	10 U	10 U	4.76 J	10 U	10 U	10 U
4-Methyl-2-Pentanone	50	μg/L	5 U	4.17 J	5 U	5 U	5 U	5 U	5 U	5 U	50 U	20 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50	μg/L	9.43 J	109	9.25 J	79.8	10 U	10 U	10 U	2560	100 U	12.2 J	10 U	4.14 J	22.7	4.34 J	10 U	10 U
Benzene	1	μg/L	0.561 J	0.669 J	0.47 J	0.462 J	0.666 J	0.86 J	0.449 J	1.62	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Disulfide	60	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.933 J	10 U	4 U	1 U	1 U	2.34	0.916 J	0.523 J	0.504 J
Chloroethane	5	μg/L	213	1 U	1 U	1 U	1 U	162	4750	515	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	5	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	0.481 J	1 U	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	μg/L	1.37	1.89	5.05	1.7	0.916 J	2.42	7.77	4.73	8.57 J	8.07	1 U	1.02	1.11	1 U	1.14	1.91
Cyclohexane		μg/L	0.427 J	1 U	1 U	1 U	1 U	0.379 J	1 U	1 U	10 U	4 U	1 U	1 U	1 U	1 U	1 U	0.413 J
Dichloromethane	5	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	5	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	31.5	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	10	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	0.473 J	0.299 J	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		μg/L	0.278 J	0.469 J	0.213 J	0.24 J	1 U	0.289 J	0.277 J	0.311 J	10 U	4 U	0.17 J	1 U	0.248 J	1 U	0.266 J	0.378 J
Tetrachloroethene	5	μg/L	1 U	2.14	2.14	1 U	1 U	1 U	1 U	1 U	8.52 J	4 U	1 U	1.04	0.433 J	1 U	1 U	1 U
Toluene	5	μg/L	1.32	3.22	1.06	1.65	4.28	2.19	1.17	3.4	10 U	4 U	0.611 J	1 U	0.773 J	1 U	0.572 J	0.702 J
trans-1,2-Dichloroethene	5	μg/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	10 U	4 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	5	μg/L	1.24	0.464 J	1.25	1 U	1 U	1.7	1.05	2.88	10 U	4 U	1 U	1 U	0.63 J	1 U	1.08	1.6
Vinyl Chloride	2	μg/L	1.15	1 U	1.06	1 U	1 U	0.993 J	4.32	1.58	10 U	4 U	1 U	1.47	1 U	1 U	1.07	1.29
Xylenes, Total	5	μg/L	1.09 J	1.58 J	2 U	1.06 J	1.71 J	2 U	2 U	179	20 U	8 U	2 U	2 U	2 U	2 U	2 U	2 U

Notes:

SCG Values = Applicable standards, criteria, and guideline values. Division of Water Technical & Operational Guidance Series (TOGS) 1.1.1 New York State

Ambient Water Quality Standards and Guidance Values and Ground Water Effluent Limitations

- Table 1 and Table 5 - Class GA; June 1998; modified January 1999;

modified April 2000; modified June 2004

*Screening level for cis-1,2-dichloroethene used for total 1,2-dichloroethene.

Bold indicates that the analyte was detected.

Grey shading indicates that the result exceeded the screening level.

µg/L = micrograms per liter

 ${\sf J}$ = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

SCG = standards, criteria, and guidelines VOC = volatile organic compound

Table 4. Detected Analytes in Groundwater – January and April 2015

Target Treatment Zone Investigation Technical Memorandum

Former Dowell Depew Facility, Depew, New York

		Location ID:	TW-10D	TW-105	TW-11D	TW-115	TW-12D	TW-12S	TW-13D	TW-13S	TW-14D	TW-14S	TW-15D	TW-155	TW-16D	TW-16S	TW-17D	TW-17S
		Sample Date:	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/1/2015	4/3/2015	4/3/2015	4/2/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015	4/3/2015
		Sample ID:	TW-10D-GW-	TW-10S-GW-	TW-11D-GW-	TW-11S-GW-	TW-12D-GW-	TW-12S-GW-	TW-13D-GW-	TW-13S-GW-	TW-14D-GW-	TW-14S-GW-	TW-15D-GW-	TW-15S-GW-	TW-16D-GW-	TW-16S-GW-	TW-17D-GW-	TW-17S-GW-
		Sumple ID.	040115	040115	040115	040115	040115	040115	040315	040315	040215	040315	040315	040315	040315	040315	040315	040315
Analyte	SCG Values	Units																
1,1,1-Trichloroethane	5	μg/L	5 U	1 U	1 U	1 U	56.4	516	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	μg/L	5 U	1 U	1.14	0.693 J	106	1010	2.01	1 U	1 U	1 UJ	0.803 J	0.833 J	1 U	1 U	1 U	0.407 J
1,1-Dichloroethene	5	μg/L	5 U	1 U	1 U	1 U	8.72	68.7	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (Total)	5*	μg/L	4.17 J	2.56	77.1	56.8	5.89 J	17.7	29.8	7.28	3.3	4.14 J	64	58.6	7.22	2.97	2 U	2 U
2-Butanone	50	μg/L	15.7 J	10 U	3.48 J	4.65 J	24.8 J	12.5 J	7.99 J	2.56 J	10 U	3.52 J	7.9 J	4.29 J	3.97 J	5.83 J	10 U	2.29 J
4-Methyl-2-Pentanone	50	μg/L	25 U	5 U	5 U	5 U	25 U	25 U	5 U	5 U	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	50	μg/L	118	12.4	30.3	35.5	42.2 J	82.2	52.5	13.6	13	49.5 J	722	150	141	119	62.9	88.9
Benzene	1	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	0.572 J	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	0.484 J	0.426 J
Carbon Disulfide	60	μg/L	5 U	1 U	0.675 J	1 U	5 U	5 U	0.377 J	1 U	1 U	1 UJ	1 U	1 U	1 U	0.982 J	1 U	0.764 J
Chloroethane	5	μg/L	5 U	1 U	1 U	1 U	5 U	5.4	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Chloromethane	5	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	μg/L	4.17 J	2.56	75.1	55.5	5.89	17.7	29.8	7.28	3.3	4.14 J	64	57.5	7.22	2.97	1 U	1 U
Cyclohexane		μg/L	5 UJ	1 UJ	1 UJ	1 UJ	5 UJ	5 UJ	0.85 J	0.837 J	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	0.402 J
Dichloromethane	5	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1.24	1 U	1 U	0.518 J
Ethylbenzene	5	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	10	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
Methylcyclohexane		μg/L	5 UJ	1 UJ	0.253 J	0.204 J	5 UJ	5 UJ	0.526 J	0.667 J	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	0.527 J
Tetrachloroethene	5	μg/L	5 U	1 U	1 U	1 U	5 U	28.4	0.389 J	1 U	1 U	1 UJ	1 U	0.699 J	1 U	1 U	1 U	1 U
Toluene	5	μg/L	5 U	1 U	1 U	1 U	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U
trans-1,2-Dichloroethene	5	μg/L	5 U	1 U	1.95	1.32	5 U	5 U	1 U	1 U	1 U	1 UJ	1 U	1.1	1 U	1 U	1 U	1 U
Trichloroethene	5	μg/L	5 U	1 U	4.75	1.58	5 U	3.43 J	1.85	1 U	0.633 J	1.6 J	1.9	7.7	0.615 J	1 U	1 U	1 U
Vinyl Chloride	2	μg/L	5 U	1 U	5.8	4.77	5 U	5 U	3.85	1.28	1 U	1 UJ	5.24	2.49	1 U	1 U	1 U	1 U
Xylenes, Total	5	μg/L	10 U	2 U	2 U	2 U	10 U	10 U	2 U	2 U	2 U	2 UJ	2 U	2 U	2 U	2 U	2 U	2 U

Notes:

SCG Values = Applicable standards, criteria, and guideline values. Division of Water Technical & Operational Guidance Series (TOGS) 1.1.1 New York State

Ambient Water Quality Standards and Guidance Values and Ground Water Effluent Limitations

- Table 1 and Table 5 - Class GA; June 1998; modified January 1999;

modified April 2000; modified June 2004

*Screening level for cis-1,2-dichloroethene used for total 1,2-dichloroethene.

Bold indicates that the analyte was detected.

Grey shading indicates that the result exceeded the screening level.

 μ g/L = micrograms per liter

 ${\sf J}$ = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for but was not detected above the reported sample quantitation limit.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

SCG = standards, criteria, and guidelines VOC = volatile organic compound

Figures



ch2m







RDD \\BALDUR\PROJ\DOWELL_DEPEW_480860\MAPFILES\2015\FIG3_SB_TW_2015.MXD_CVONFREE 6/4/2015 2:20:40 PM



And in case of the local division of the loc	and the second se											1
		Location	TW-02S	Location	TW-06S	Location	TW-01S	Location	TW-03S	Location	TW-07S	
and the second se		Screen Interval (ft bgs)	15-20	Screen Interval (ft bgs)	15-20	Screen Interval (ft bgs)	15-20	Screen Interval (ft bgs)	15-20	Screen Interval (ft bgs)	14.8-19.8	
the second se		Sample Date	01/28/15	Sample Date	02/04/15	Sample Date	01/27/15	Sample Date	01/27/15	Sample Date	02/04/15	
and the second		Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	
Location	TW-12S	1,1,1-Trichloroethane	3.31	1,1,1-Trichloroethane	2.17	1,1,1-Trichloroethane	209	1,1,1-Trichloroethane	17.6	1,1,1-Trichloroethane	1 U	
Screen Interval (ft bgs)	15-20	1,1-Dichloroethane	1.73	1,1-Dichloroethane	3.75	1,1-Dichloroethane	49.3	1,1-Dichloroethane	11,900	1,1-Dichloroethane	2.63	
Sample Date	04/01/15	1,1-Dichloroethene	1.61	1,1-Dichloroethene	1.23	1,1-Dichloroethene	75.7	1,1-Dichloroethene	8.44	1,1-Dichloroethene	1 U	
Analyte	Results (ug/L)	1.2-Dichloroethane	1 U	1.2-Dichloroethane	1 U	1.2-Dichloroethane	0.739 J	1.2-Dichloroethane	3.57	1.2-Dichloroethane	1 U	
1 1 1-Trichloroethane	516	Chloroethane	1U	Chloroethane	1 U	Chloroethane	1 U	Chloroethane	4.750	Chloroethane	1U	
1 1-Dichloroethane	1 010	cis_1 2-Dichloroethene	0.016 T	cis_1 2-Dichloroethene	1.02	cis_1 2-Dichloroethene	5.05	cis_1 2-Dichloroethene	7 77	cis-1 2-Dichloroethene	111	_
1,1-Dichloroothono	687	Tatrashlarasthana	111		1.02	Tatraphlaraathana	2.14	Tatrachlaracthana	1.11	Tatrapharaathara	10	
1,1-Dichloroethene	5.11	Visual Chlorida	111		1.04	Visual Chlorida	2.14		10	Visual Chlorida	111	
1,2-Dichloroethane	50	vinyi Chioride	10	Vinyi Chionde	1.47	Vinyi Chloride	1.00	Vinyi Chloride	4.32	Vinyi Chionde	10	1
Chloroethane	5.4							/				
cis-1,2-Dichloroethene	17.7				ALC: NOT					/	PZ-0	8S /
Tetrachloroethene	28.4											
Vinyl Chloride	5 U							/1				
							TW-04D	RW-01D	TW-08D			
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1							- IW-04D		•			
and the second sec						M N	N-06S	TW-035 RW-01			/	
Location	TW-05S								/			
Screen Interval (ft bgs)	14.8-19.8							TW-03D				
Sample Date	02/04/15						V=06D GIECH=	JZ			/	
	Results (ug/L)		MW-07S			TW-06D				/		
1 1 1-Trichloroethane	136				TM	102D TW-02S		1W-078	TW-09D			
1,1,1 ⁻ Inchloroothano	160											
1,1-Dichloroethane	107	i i	MW-0	7D			🎦 TW-01D	1W-07D				
1,1-Dichloroethene	29.3		1			TW-018	6			/		
1,2-Dichloroethane	40		1			۱		and the second se				
Chloroethane	4 U		1									
cis-1,2-Dichloroethene	8.07					TW-12S			1/1			
Tetrachloroethene	4 U .					TW-12D	TW-05S		r			
Vinyl Chloride	4 U					1	TW-05D	TW-11D	1			
		The Berlin and St.						· · · · · · · · · · · · · · · · · · ·	1			
Location	TW-16S					1		TW-11S	/ TW-17S			
Screen Interval (ft bgs)	15-20					TW416S		,				
Sample Date	04/03/15					TW-14 D	TW-14S	TW-15S		1	1	
Analyte	Results (µg/L)				_ = = =	-TW-16D			(ma			
1,1,1-Trichloroethane	1 U				====		-100	-15D.	135			
1,1-Dichloroethane	1 U							TW-13			RW	-02
1.1-Dichloroethene	1 U											
1 2-Dichloroethane	1 U						TW-10S			~	ALC: NOTE: N	Note
Chloroethane	111										100 C	1. J
cis 1.2 Dichloroothono	2.07						TW-10D				1000	th
Totrachloroothono	111											2. U
Vigul Chlorido	111	Location	TW-14S	Location	TW-10S		Locati	on T\	V-15S Lo	ocation	TW-13S	d
villyi chiofide	10	Screen Interval (ft bgs)	15-20	Screen Interval (ft bgs)	15-20		Scree	n Interval (ft bgs) 1	5-20 Se	creen Interval (ft bgs)	15-20	ა. U r4
		Sample Date	04/03/15	Sample Date	04/01/15		Sampl	e Date 04	/03/15 Sa	ample Date	04/03/15	re
BUFFALORA		Analyte	Results (µg/L)	Analyte	Results (µg/L)		Analy	te Resu	ts (μg/L) 🛛 🗛	nalyte	Results (µg/L)	0
AND FELT		1,1,1-Trichloroethane	1 UJ	1,1,1-Trichloroethane	1 U	PZ-04D	1,1,1-	Trichloroethane	1 U 1,	1,1-Trichloroethane	1 U	n
		1,1-Dichloroethane	1 UJ	1,1-Dichloroethane	1 U		1,1-Di	chloroethane 0.	833 J 1,	1-Dichloroethane	1 U	4. ft
		1,1-Dichloroethene	1 UJ	1,1-Dichloroethene	1 U	▲ PZ-04S		chloroethene	1 U 1,	1-Dichloroethene	1U	5. µ
		1.2-Dichloroethane	1 UJ	1.2-Dichloroethane	1 U		1.2-Di	chloroethane	1U 1	2-Dichloroethane	1U	6. V
		Chloroethane	1 UJ	Chloroethane	1 U		Chlore	bethane	1U r	hloroethane	1U	8. S
and the second se		cis-1 2-Dichloroethene	4.14 J	cis-1 2-Dichloroethene	2.56	Statements of the local division in which the local division in th	cis-1 2	P-Dichloroethene	57.5 ci	s-1 2-Dichloroethene	7.28	a
-		Tetrachloroethene	1111	Tetrachloroethene	111		Tetrac	hloroethene	699 J	etrachloroethene	1U	9 1
	erosoft 2011	Vinyl Chlorido	1 111	Vinyl Chlorido	111		Viewle	Chloride	2 49	invl Chlorido	1.28	э. ц
	0000002011	villyi cillonde	103	vinyi ciliolide	10		vinyi				1,40	
LLGEND	_											
Site Boundary		Target Treatme	nt Zone 🛛 🕤	Temporary Well (Sh	allow) 🕤	Monitoring Well / Re	covery Well in	Upper Till				
Eormor Duildin		Formar Concre	to 🔦		· · ·	Monitoring Wall / Da					_	
	ig Location -		ເຍ 😈	remporary well (De	ieh) 🥥	wonitoring weil / Re	covery well in		м	VOCs Ex	ceeding SCG Va	lue
Former Tank			•	Geotechnical Boring	g 🔺	Piezometer in Uppe	r Till		0 10	₂₀ Targe	t Treatment Zon	ie li
			_		~	Diagonatoria	» Т:Ш				Former I	Dov
						Plezometer in Lowe	1		Feet		. critici L	

MW-04	
Location	TW-11S
Screen Interval (ft bgs)	15-20
Sample Date	04/01/15
Analyte	Results (µg/L)
1,1,1-Trichloroethane	1 U
1,1-Dichloroethane	0.693 J
1,1-Dichloroethene	1 U
1,2-Dichloroethane	1 U
Chloroethane	1 U
cis-1,2-Dichloroethene	55.5
Tetrachloroethene	1 U
Vinul Chlorido	4 77
Villyi Chionde	4.//
Location	4.77 TW-17S
Location Screen Interval (ft bgs)	4.77 TW-17S 15-20
Location Screen Interval (ft bgs) Sample Date	4.77 TW-17S 15-20 04/03/15
Location Screen Interval (ft bgs) Sample Date Analyte	4.77 TW-17S 15-20 04/03/15 Results (μg/L)
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane	4.77 TW-17S 15-20 04/03/15 Results (μg/L) 1 U
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane	4.77 TW-17S 15-20 04/03/15 Results (μg/L) 1 U 0.407 J
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethane	4.// TW-17S 15-20 04/03/15 Results (μg/L) 1 U 0.407 J 1 U
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane 1,2-Dichloroethane	4.// TW-17S 15-20 04/03/15 Results (μg/L) 1 U 0.407 J 1 U 1 U 1 U
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethane 1,2-Dichloroethane Chloroethane	4.77 TW-17S 15-20 04/03/15 Results (μg/L) 1 U 0.407 J 1 U 1 U 1 U 1 U
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane 1,2-Dichloroethane 1,2-Dichloroethane Chloroethane cis-1,2-Dichloroethene	4.77 TW-17S 15-20 04/03/15 Results (μg/L) 1 U 0.407 J 1 U 1 U 1 U 1 U 1 U
Location Screen Interval (ft bgs) Sample Date Analyte 1,1,1-Trichloroethane 1,1-Dichloroethane 1,2-Dichloroethane 1,2-Dichloroethane Chloroethane cis-1,2-Dichloroethane Tetrachloroethene	4.// TW-17S 15-20 04/03/15 Results (μg/L) 1 U 1 U 1 U 1 U 1 U 1 U 1 U 1 U 1 U

- Notes: 1. J = The analyte was positively identified, the associated numerical value is the
- approximate concentration.
 U = The analyte was analyzed for, but was not detected above the reported sample detection limit.
 U J = The analyte was not detected above the sample detection limit. reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
- 4. ft bgs = feet below ground surface
- . μg/L = micrograms per liter
- VOC = volatile organic compound Bold indicates the analyte was detected
- Shading indicates that the result exceeded applicable standards, criteria, and guideline
- e) Location of former buildings, tanks, concrete, and features is approximate.

lues (Shallow) - January and April 2015 ne Investigation Technical Memorandum Dowell Depew Facility, Depew, New York



FIGURE 4

												_		
Location	TW-02D	Location	TW-01D	Location	TW-06D	Location	TW-04D	Location	TW-03D	Location	RW-01D	1000	Location	TW-08D
Screen Interval (ft bgs)	25-30	Screen Interval (ft hgs)	24-29	Screen Interval (ft bgs)	25-30	Screen Interval (ft bgs)	24 5-29 5	Screen Interval (ft bgs)	24 5-29 5	Screen Interval (ft bgs)	24-29		Screen Interval (ft hgs)	23 5-28 5
Sample Date	01/27/15	Sample Date	01/27/15	Sample Date	2/4/2015	Sample Date	01/20/15	Sample Date	01/27/15	Sample Date	01/20/15	100	Sample Date	02/04/15
Sample Date	01/2//13	Angleta	01/2//13		2/4/2013	Sample Date	01/30/13	Sample Date	01/2//13				Sample Date	02/04/13
Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Anaryte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	-	Analyte	Results (µg/L)
1,1,1-Trichloroethane	0.0	1,1,1-Trichloroethane	63.4	1,1,1-Trichloroethane	10	1,1,1-Trichloroethane	43.7	1,1,1-Trichloroethane	40.8	1,1,1-Trichloroethane	3.05		1,1,1-Trichloroethane	10
1,1-Dichloroethane	4.19	1,1-Dichloroethane	10.7	1,1-Dichloroethane	0.884 J	1,1-Dichloroethane	3,330 J	1,1-Dichloroethane	304	1,1-Dichloroethane	652		1,1-Dichloroethane	3.74
1,1-Dichloroethene	2.51	1,1-Dichloroethene	16.8	1,1-Dichloroethene	0.668 J	1,1-Dichloroethene	8.39	1,1-Dichloroethene	3.59	1,1-Dichloroethene	1.4		1,1-Dichloroethene	0.383 J
1,2-Dichloroethane	1 U	1,2-Dichloroethane	1 U	1,2-Dichloroethane	1 U	1,2-Dichloroethane	0.966 J	1,2-Dichloroethane	1 U	1,2-Dichloroethane	1 U		1,2-Dichloroethane	1 U
Chloroethane	1 U	Chloroethane	1 U	Chloroethane	1 U	Chloroethane	515	Chloroethane	162	Chloroethane	213		Chloroethane	1 U
cis-1.2-Dichloroethene	1.7	cis-1.2-Dichloroethene	1.89	Ecis-1.2-Dichloroethene	1 U	cis-1.2-Dichloroethene	4.73	cis-1.2-Dichloroethene	2.42	cis-1.2-Dichloroethene	1.37	1000	cis-1.2-Dichloroethene	1.14
Totrachloroothono	111	Tatrachloroathana	214	Totrachloroothono	111	Totrachloroothono	111	Totrachloroothono	111	Totrachloroothono	111		Totrachloroothono	111
Visul Chlorido	1.0	Vinul Chlorida	111	Visul Chlorido	10	Vinul Chlorida	1.59	Visul Chlorida	0.002 I		115		Visul Chlorido	1.07
Vinyi Chioride	10	Vinyi Chionde	10	Vinyi Chionde	10	Vinyi Chioride	1.56	vinyi chionde	0.995 J	Vinyi Chionde	1.15		vinyi Chionde	1.07
		and the second second											MW-04	
								5-1				PZ-083	5	
Location	TW-12D			_									Location	TW-07D
Screen Interval (ft bgs)	22.5-27.5						TWIND	RW-01D						100-070
Sample Date	04/01/15						-10-040		9				Screen Interval (ft bgs)	22.1-27.1
Analyte	Results (µg/L)						V-065	DW 01	TW-08D				Sample Date	02/04/15
1 1 1-Trichloroethane	56.4						GTECH-0	1 IW-03S					Analyte	Results (µg/L)
1 1-Dichloroethane	106							🨼 TW-03D 🕔	/		714/00	<u> </u>	1,1,1-Trichloroethane	3.84
1,1-Dichloroethane	9.72					TW-06S 🌄 💧 MW-06	6D 💛 GTECH-	-02		Location	IW-09	D	1,1-Dichloroethane	20
1,1-Dichloroethene	8./2 5.11					TW-06D		TŴ	-09D	Screen Interval (ft b	gs) 24.5-29	0.5	1,1-Dichloroethene	0.96 J
1,2-Dichloroethane	50		MW-075		TW	-02S		TW-07S		Sample Date	02/04/	15	1.2-Dichloroethane	1 U
Chloroethane	5 U				TW	1-02D¥				Analyte	Results (µ	ug/L)	Chloroethane	1U
cis-1,2-Dichloroethene	5.89							TW-07D	•	1,1,1-Trichloroethar	ie 1.34		cis 1.2 Dichloroothono	111
Tetrachloroethene	5 U					TW-01S 🔨	5 TW-01D		•	1.1-Dichloroethane	10.3			1.11 0.422 I
Vinyl Chloride	5 U									1 1-Dichloroethene	0.568	T	letrachloroethene	0.433 J
			MW-07D						1	1,1 Dichloroothana	1.11	, 	Vinyl Chloride	1 U
Location	TW-05D									1,2-DiciliorOetilalie	10	_		
Screen Interval (ft bgs)	22.3-27.3					TW-12S				Chloroethane	10	_		
Sample Date	02/04/15						TW-05S	TW-11D	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	cis-1,2-Dichloroethe	ine 1.91	_		
Analyte	Results (µg/L)	100 100 10 10 10				TW-12D			1	Tetrachloroethene	1 U	_		TH 170
1.1.1-Trichloroethane	248	The second second						TW-118		Vinyl Chloride	1.29	_	Location	TW-1/D
1 1-Dichloroethane	297					1	and the second se		W-17S				Screen Interval (ft bgs)	22.5-27.5
1,1 Dichloroothano	46.3					TWHEN			TW-17D	1			Sample Date	04/03/15
	40.5					TW-14D	TW-14S	TW-15D			1		Analyte	Results (µg/L)
1,2-Dichloroethane	10 0					TW-16D) 🔒 🔔 🚬 🖉	TW-15S					1,1,1-Trichloroethane	1 U
Chloroethane	10 U						1	• / L 👌 TW	-135				1.1-Dichloroethane	1 U
cis-1,2-Dichloroethene	8.57 J						1	/ T	/-13D		R\	N-02	1 1-Dichloroethene	1U
Tetrachloroethene	8.52 J				/		1						1,1 Dichloroothana	111
Vinyl Chloride	10 U						TW-108							10
the state is a second s						TW							Chloroethane	10
	TH/ 46D						<u>→</u> /						cis-1,2-Dichloroethene	IU
Location	TW-16D												 Tetrachloroethene 	1 U
Screen Interval (ft bgs)	23-28						/						Vinyl Chloride	1 U
Sample Date	04/03/15	location	TW-1/D	Location	TW-100	Location	TW-15D	Location	TW-13D	location	TW-11D			
Analyte	Results (µg/L)	Screen Interval (ft bac)	27_27	Screen Interval (ft bac)	22.20	Screen Interval (ft bac)	22-27	Screen Interval (ft has)	22 1-27 1	Screen Interval (ft bac)	22 5-27 5	Notes:		
1,1,1-Trichloroethane	1 U	Screen Interval (11 DgS)	22-21	Screen milerval (it bgs)	23-20	Screen mervar (it bgs)	22-21	Screen interval (it bgs)	22.1-27.1	Screen mervar (it bgs)	22.3-21.3	1. J =	The analyte was positively ide	entified,
1,1-Dichloroethane	1 U	sample Date	04/02/15	Sample Date	04/01/15	sample Date	04/03/15	sample Date	04/03/15	sample Date	04/01/15	the	associated numerical value is	the
1.1-Dichloroethene	1 U	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	Analyte	Results (µg/L)	app 2 [] -	The analyte was analyzed for	, but was not
1 2-Dichloroethane	1 U	1,1,1-Trichloroethane	1 U	1,1,1-Trichloroethane	5 U	1,1,1-Trichloroethane	1 U	1,1,1-Trichloroethane	1 U	1,1,1-Trichloroethane	1 U	dete	ected above the reported sam	ple detection limit.
Chloroothana	10	1,1-Dichloroethane	1 U	1,1-Dichloroethane	5 U	1,1-Dichloroethane	0.803 J	1,1-Dichloroethane	2.01	1,1-Dichloroethane	1.14	3. ft bg	gs = feet below ground surface	e
	7.02	1,1-Dichloroethene	1 U	1,1-Dichloroethene	5 U	1,1-Dichloroethene	1 U	1,1-Dichloroethene	1 U	1,1-Dichloroethene	1 U	4. µg/L	= micrograms per liter	, I
cis-1,2-Dichloroethene	7.22	1.2-Dichloroethane	1 U	1.2-Dichloroethane	5 U	1.2-Dichloroethane	1 U	1.2-Dichloroethane	1 U	1.2-Dichloroethane	1 U	5. VOC	d indicates the analyte was de	atected
Tetrachloroethene	1 U	Chloroethane	1 U	Chloroethane	5 U	Chloroethane	1 U	Chloroethane	1 U	Chloroethane	1 U	7. Sha	ding indicates that the result	exceeded
Vinyl Chloride	1 U	cis-1 2-Dichloroathono	33	cis-1 2-Dichloroathono	4 17 I	cis-1 2-Dichloroethono	64	cis-1 2-Dichloroethono	29.8	cis-1 2-Dichloroethono	75.1	app	licable standards, criteria, and	d guideline
			111				1 11		47.0 0.200 T		111	(SC	G) values.	s concrete
	B	letrachioroethene	10	retrachioroethene	30	retrachioroethene	10	retrachioroethene	0.389 J	retrachioroethene	10	o. LOC	features is approximate	s, concrete,
Image Source: ESRI-M	Icrosoft 2011	Vinyl Chloride	10	Vinyl Chloride	50	Vinyl Chloride	5.24	Vinyl Chloride	3.85	Vinyl Chloride	5.8			
LEGEND														
Site Boundar	ry	Target Treatme	ent Zone 🛛 🕤	Temporary Well (S	shallow) 🕤 🕤	Monitoring Well / R	ecovery Well	in Upper Till	1					
	•			T	, -		, , , , , , , , , , , , , , , , , , ,	··· ·· ···						FIGURE 5
I Former Build	ing Location	—— ⊢ormer Concre	ete 🔸	temporary Well (D	veep) 🔂	Monitoring Well / R	ecovery Well	In Lower III	N		Exceeding SC	G Valu	es (Deen) - January a	and Anril 2015
Former Tank			0	Geotechnical Bori	ng 🔺	Piezometer in Llon	er Till		•	Towned	Troatmant 7-		ectigation Tashnical	Momorandum
			-		.9	. iozomotor in opp	· · · · ·		0 <u>1</u> 0	20 large				wienioranuum
									Foot	<u> </u>	Formei	Dowe	ni Depew Facility, De	pew, New York
									1 661					



Attachment 1 Topographic Survey Map



valid and true copies.

Temporary Well Locations and Elevations										
Identifier	Northing	Easting	Top of 1" PVC Riser Pipe Elevation	Ground Elevation						
RW-01D	1,061,168.1	1,118,969.5	N/A	677.6						
TW-01 S&D	1,061,144.6	1,118,936.8	N/A	677.4						
TW-02 S&D	1,061,151.1	1,118,918.3	N/A	677.5						
TW-03 S&D	1,061,161.3	1,118,963.0	N/A	677.4						
TW-04D	1,061,167.8	1,118,941.2	N/A	677.4						
TW-05 S&D	1,061,127.6	1,118,941.8	N/A	677.5						
TW-06 S&D	1,061,158.7	1,118,926.4	N/A	677.4						
TW-07 S&D	1,061,149.3	1,118,961.2	N/A	677.8						
TW-08D	1,061,169.1	1,118,983.6	N/A	677.4						
TW-09D	1,061,151.7	1,118,978.8	N/A	677.7						
TW-10D	1,061,096.1	1,118,942.1	N/A	677.7						
TW-10S	1,061,097.0	1,118,944.2	N/A	677.7						
TW-11D	1,061,125.4	1,118,968.1	N/A	677.8						
TW-11S	1,061,124.1	1,118,968.9	N/A	677.8						
TW-12D	1,061,128.9	1,118,924.0	N/A	677.4						
TW-12S	1,061,129.6	1,118,926.5	N/A	677.5						
TW-13D	1,061,107.6	1,118,974.0	N/A	678.0						
TW-13S	1,061,109.6	1,118,973.7	N/A	678.0						
TW-14D	1,061,112.6	1,118,936.5	680.11	677.7						
TW-14S	1,061,112.8	1,118,939.5	678.85	677.5						
TW-15D	1,061,112.7	1,118,957.8	N/A	677.8						
TW-15S	1,061,112.7	1,118,959.7	N/A	677.7						
TW-16D	1,061,114.2	1,118,921.0	678.77	677.6						
TW-165	1,061,114.6	1,118,922.3	679.15	677.6						
TW-17D	1,061,117.6	1,118,984.4	680.33	678.2						
TW-175	1.061.118.6	1.118.982.9	679.54	678.2						

Monitor Well Locations and Elevations											
Identifier	Northing	Easting	Top of 6" Steel Protective Casing Elevation	Top of 2" PVC Riser Pipe Elevation	Ground Elevation						
MW-01	1,060,918.9	1,118,926.5	680.66	680.38	680.7						
MW-02	1,061,207.4	1,119,169.4	679.10	678.83	679.1						
MW-04	1,061,182.2	1,119,049.1	678.14	677.71	678.1						
MW-06D	1,061,162.1	1,118,940.1	677.45	677.16	677.5						
MW-06S	1,061,160.4	1,118,936.4	677.54	677.13	677.5						
MW-07D	1,061,142.0	1,118,861.8	677.43	676.83	677.4						
MW-07S	1,061,150.1	1,118,858.4	677.17	676.66	677.2						

									GF	RAPHIC SC,	ALE
	Piezomete	er Locations ar	nd Elevations					20 	0 10 2 I I	20 4 I	40 80 I I
Identifier	Northing	Easting	Top of 1" PVC Riser Pipe Elevation	Ground Elevation						(IN FEET)	
PZ-01D	1,061,004.0	1,118,926.2	681.88	678.9						1 inch = 20 ft.	
PZ-01S	1,061,010.3	1,118,925.1	681.49	678.4							
PZ-02S	1,060,920.1	1,118,923.8	684.53	680.7						DRAWN:	Man Chawing
PZ-03D	1,061,043.1	1,119,053.0	682.60	680.4							wap Snowing
PZ-03S	1,061,038.8	1,119,046.9	683.08	680.1						R.D.S.	Existing Topographic Conditions
PZ-04D	1,061,074.2	1,118,919.8	681.44	678.2						CHECKED:	Earmar Dowall Danow Escility
PZ-04S	1,061,070.0	1,118,915.1	681.23	678.2				_		JST	Former Dowen Depew Facility
PZ-05D	1,061,118.0	1,119,132.2	682.85	679.5						0.0.77	3311 Walden Avenue
PZ-05S	1,061,114.2	1,119,128.3	682.19	679.6						SCALE:	Town of Depew
PZ-07D	1,061,164.5	1,119,103.5	681.91	679.0				-		1" = 20'	County of Erie
PZ-07S	1,061,161.6	1,119,094.9	681.93	679.0						7 = 20	State of New York
PZ-08S	1,061,181.1	1,119,044.4	681.90	678.2						DATE:	
PZ-09S	1,061,202.3	1,119,170.9	683.16	679.2	2	Misc. Revisions	06/05/	5		04/28/2015	P.O. Box 463 6431 US Highway 11 6431 US Highway 11 A ND S U B V F Y O B S Marcy, New York 13403
					1	Misc. Revisions	06/04/1	PROJEC	T NUMBER:		Canton, New York 13617 T: 315/386-2776 F: 315/386-20776 Www.ThewAssociates.com
	Copyri	ight © 2015 Thew .	Associates PE-LS. F	PLLC - All Rights Res	erved RE	V DESCRIPTION	DATE		UK532-03-15		

of 4" PVC	Ground					
er Pipe	Elevation					
vation						
80.34	677.8					
81.16	678.7					

of 2" PVC ser Pipe evation	Ground Elevation
579.75	677.6
579.99	677.6
680.13	677.7
680.07	677.6
680.52	677.7
579.76	677.5



Leger	<u>nd:</u>
679.5	Minor Contour
680.0	Major Contour
	Sanitary Line
	Storm Line
oo	Chain Link Fence
	Edge of Gravel
	Edge of Brush
ОНИ	Overhead Utilities (Electric, Telephone and Cable TV)
	Overhead Electric
OHT	Overhead Telephone
UGU	Unknown Underground Utilities (Marked by others)
GAS	Gas Line (Marked by others)
	Water Line (Marked by others)
<i>W</i>	Water Line (Plan location)
W	Water Line (Abandoned in place)
	Catch Basin
\bigcirc	Drainage Manhole
S	Sanitary Manhole
0	Utility Pole
ဨႝႜ	Utility Pole with Light
	Electric Meter
	Gas Meter
CV X	Gas Valve
O GAS TEST	Gas Test
L'AL L'AL	Deciduos Tree
۲	Piezometer
•	Monitor, Injection or Temporary Well
+ 680.55	Spot Elevation
o	Sign
\leftarrow	Guy Wire
₩V ⋈	Water Valve
ж	Fire Hydrant
ö	Clean out
95Q 5301 1055	Mile Marker
\triangle	Set 5/8-inch by 30-inch long rebar with a 1 1/4-inch diameter orange plastic cap marked "THEW BASELINE"

General Notes:

- 1. This survey is referenced horizontally to the North American Datum of 1983-2011 Adjustment (NAD83/2011) and projected on the New York State Plane Coordinate System (West Zone).
- 2. North arrow as shown indicates Grid North referenced to NAD83/2011 and projected on the New York State Plane Coordinate System (West Zone).
- 3. The reference horizontal control station and benchmark is a Cooperative Base Network Control Station designated as "BUFPORT". BUFPORT is a horizontal and vertical Control Station established by the National Geodetic Survey (NGS) in 1988. Elev. 661.57 feet.
- 4. The subsurface utilities shown hereon are of Quality Level "C" as defined by the American Society of Civil Engineers (ASCE) in the "Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data". The subsurface utilities shown hereon are based on physical evidence located during the field survey and existing utility drawings. The surveyor further does not warrant or certify that the subsurface utilities are in the exact location indicated although he does certify that they are depicted as accurately as possible from the information available. This surveyor has not physically located the subsurface utilities.
- 5. The information shown hereon is based on a field survey completed on April 3, 2015.
- 6. The horizontal location of TW-07 S&D was obtained by CH2M HILL utilizing a hand held global positioning system unit. The ground elevation was interpolated from existing ground elevations.

Attachment 2 Soil Boring Logs



PROJECT NUMBER: 480860 BORING NUMBER: GTECH-01

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :			START : 1/28/2015	END : 1/28/201	5	LOGGER : R. Clennon	
202				SOIL DESCRIPTION	()		
DEPTH BELOV SURFACE ANE ELEVATION (ft	SAMPLE IN	FERVAL (ft)	(ft) SAMPLER (TYPE)	DEPTH INTERVAL, SOIL NAME, USCS C SYMBOL, COLOR, MOISTURE CONTI RELATIVE DENSITY OR CONSISTENCY STRUCTURE, MINERALOGY	GROUP ENT, (, SOIL	PID (ppm)	COMMENTS
	4.0	<u>3.75</u> 4.0	S1	Sandy Silt (SM) 0.0-0.75' - 10YR 2/2, very dark brown, mois dense, fine grained sand, trace to little clay Gravel, Sand, Silt 0.75-2.8' - 10YR 2/2, 2/1, 3/1, very dark brown very dark gray, fine to coarse sub-angular g white concrete or rock fragments in 1.1-1.2 8/1 Silty Clay (CL) 2.8-3.75' - 10YR 4/3 to 7.5YR 4/2, brown, n	st to wet, wm, black, gravel, - 10YR - noist, stiff	0.0 0.0	Breathing Zone = 0.0 ppm Collect Sample: GTECH-01-SL0103-012815 at 0915 Driller: hard drilling in ~ 1 to 1.5'
- 5 - - - - -	8.0	<u>4.0</u> 4.0	S2	3.75-4.0 - ho recovery Sandy Gravel (SW) 4.0-4.25' - 10YR 2/2 and 2/1, very dark brov black, wet to saturated, some medium to co fine to coarse grained sub-round gravel Clay (CL) 4.25-8.0' - 10YR 4/4 and 7.5YR 4/4, dark yu brown and brown, moist to wet, very stiff, fe silt	wn to barse sand, ellowish w to some	0.0	
- - - - - - - -		<u>3.3</u> 4.0	S3	Silty Clay (CL) 8.0-11.3' - 7.5YR 4/3, brown, moist, very sti plasticity 11.3-12.0' - no recovery	ff, slight -	0.0	
- - - - 15 -	12.0	<u>3.8</u> 4.0	S4	Silty Clay (CL) 12.0-14.0' - 7.5YR 4/3, brown, moist, stiff, s plasticity Clay (CL) 14.0-15.8' - 7.5YR 4/3, 7.5YR 4/1, brown w gray, moist to wet, moderately stiff, trace fir coarse sub-angular gravel 15.8-16.0' - no recovery Silt= Clay (CL)	ilight -	0.0	- - - - - - - - - - - - - - - - - - -
- - - - - - - - - - - - - - - - - - -	20.0	<u>4.0</u> 4.0	S5	Silty Clay (CL) 16.0-20.0' - 7.5YR 4/2, brown, moist, soft to stiff, trace sand and fine to coarse sub-rour sub-angular gravel	o medium nd to	1.1	



GTECH-01

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/28/2015 END: 1/28/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Silty Clay (CL) 20.0-24.0' - 7.5YR 4/2 to 4/3, brown, moist, stiff to 20.0 medium stiff, trace gravel, coarse sand <u>4.0</u> 4.0 S6 Collect Sample: GTECH-01-SL2224-012518 at 1345 Driller: Hit hard refusal at 23 ft bgs -Driller: Hit hard refusal at 23 ft bgs -not to target depth. Step off 3 ft to reach target depth. Second boring only able to reach 24 ft bgs. Substantial glacial erratic prevents sampler from reaching target depth.\ Geologist: Consult with Project 24.0 Bottom of Boring at 24.0 ft below ground surface 25 Manager and Senior Technical Consultant - adjust sample depth to 22-24 ft bgs. 30 35 40



GTECH-02

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

١	WA	TER	LE	VEL	s	:	

WATER LEV	VATER LEVELS :			START : 1/28/2015 END : 1/28		2015 LOGGER : R. Clennon		
				SOIL DESCRIPTION				
DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INT	ERVAL (ft)	(ft) SAMPLER (TYPE)	DEPTH INTERVAL, SOIL NAME, USCS GRO SYMBOL, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE, MINERALOGY	oup T, Soil	GRAPHIC LOG	PID (ppm)	COMMENTS
- - - - - - - - - - - - - - - - - - -				Note: No continuous soil sampling conducted performed with augers - adjacent to logged lo GTECH-01 for push and collection of Shelby sample at target intervals	- drilling cation - Tube _ - - - - - - - - - - - - - - - - - - -		0.0	Breathing Zone = 0.0 ppm
- - 10 - - - - - - - - - - - - -								-
								- Collect Sample: GTECH-02-SL1517-012815 at 1620 - - - - - - - -
20								



BORING NUMBER: PROJECT NUMBER: 480860

GTECH-02

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/28/2015 END: 1/28/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY ШЦ Collect Sample: GTECH-02-SL2224-013015 at 1240 25_ Bottom of Boring at 24.0 ft below ground surface 30 35 40



PROJECT NUMBER: 480860

BORING NUMBER: RW-01D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/29/2015 END: 1/29/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Silty Sand (SP-SM) Geologist: Unable to collect ambient 0.0-1.5' - 10YR 4/2, dark grayish brown, wet, moderately dense, fine to medium sand, little to few headspace readings due to rain/snow conditions coarse sand, fine to coarse sub-angular gravel, poorly 0.0 sorted Silty Sand (SP-SM) <u>2.85</u> 4.0 S1 1.5-2.85' - 10YR 3/1, saturated, moderately dense, fine to medium sand, little to few coarse sand, fine to coarse sub-angular gravel, poorly sorted, trace to little clay 0.0 2.85-4.0' - no recovery 4.0 Silty Sand (SP-SM) 4.0-5.45' - 10YR 3/1, saturated, moderately dense, fine to medium sand, little to few coarse sand, some 5 fine to coarse sub-angular gravel, poorly sorted, trace to little clay 5.45-8.0' - no recovery S2 <u>1.45</u> 4.0 0.0 8.0 8.0-12.0' - no recovery 10 0.0 S3 4.0 12.0 12.0-16.0' - no recovery <u>0.0</u> 4.0 S4 15 16.0 16.0-20.0' - no recovery <u>0.0</u> 4.0 S5 20.0 20



RW-01D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :			START : 1/29/2015 END : 1/29/2015		5	LOGGER : R. Clennon		
				SOIL DESCRIPTION				
AND 4 (ft)	SAMPLE INT	ERVAL (ft)						
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTEN	T, PH	(md	COMMENTS	
EVA			SAMPLER	RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE. MINERALOGY	SOIL A	d) D		
ESE			(TYPE)		0			
_	20.0			20.0-23.55' - 7.5YR 4/2 to 5YR 4/2. brown to d	lark	0.0	-	
_				reddish brown, wet, stiff to soft, trace coarse s	and and		-	
-				tine to coarse sub-round to sub-angular grave			-	
_		3 55	56			1	-	
_		4.0				48.4	-	
_							-	
_							_	
_	24.0			23.55-24.0' - no recovery			_	
				Silty Clay (CL)			Set Temporary Well from 24-29 ft bgs	
25				reddish brown, wet, stiff to soft, trace coarse s	and and		VOC analysis	
				fine to coarse sub-round to sub-angular grave		1	RW-01D-GW-013015 @ 1020	
_		4.0	07				-	
_		<u>4.0</u> 4.0	57			6.0	-	
_		-				1	-	
_							-	
_	28.0						-	
-				Silty Clay (CL)		0.0	-	
-	29.0	<u>0.45</u> 1.0	S8	28.0-28.45' - 7.5YR 4/2 to 5YR 4/2, brown to o	lark	1	-	
-				fine to coarse sub-round to sub-angular grave	I	0.0	Driller: Hit refusal at 29 ft bgs	
- 30				28.45-29.0' - no recovery	/ -		-	
00_				Bottom of Boring at 29.0 ft below ground suffa	ice			
-					-		-	
-					-		-	
-					-		-	
-					-		-	
-					-		-	
-					-		-	
-					-		-	
-					-		-	
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30								
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-					-		-	
-					-		-	
-					-		-	
-					-		-	
-					-		-	
							-	
40								



TW-01D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :			START : 1/26/2015 END : 1/26/20		2015 LOGGER : R. Clennon		
				SOIL DESCRIPTION			
TH BELOW FACE AND VATION (ff)	SAMPLE INTERVAL (ft) RECOVERY (ft)		(ft)	DEPTH INTERVAL, SOIL NAME, USCS GROUP		(mdd)	COMMENTS
DEP SUR ELE			(TYPE)	STRUCTURE, MINERALOGY	GRV	DIA	
		<u>3.3</u> 4.0	S1	Sandy Silt (SM) 0.0-1.5' - 10YR 4/4 and 10YR 2/2, dark yellowis brown and very dark brown, dense to very dens to medium sand, trace coarse sand and fine gra Clayey Silt (SM/CL) 1.5-2.0' - 10YR 4/2, brown, damp, very dense Silty Clay (CL) 2.0-3.3' - 7.5Y 4/3, brown, damp to moist, very : 3.3-4.0' - no recovery	sh	3.2	Breathing Zone = 0.0 ppm - - - - - - -
5	4.0			Clay (CL) 4.0-7.9' - 7.5Y 3/3, brown, moist, stiff, some silt		3.3	-
-		<u>3.9</u> 4.0	S2			1.2	-
	8.0	<u>4.0</u> 4.0	S3	7.9-8.0' - no recovery Clay (CL) 8.0-12.0' - 7.5Y 3/3, brown, moist, stiff, some si		2.6 14.8	- - - - - - - -
- - - - - - - - - - - - - - - - - - -	12.0	<u>4.0</u> 4.0	S4	Clay (CL) 12.0-16.0' - 5YR 4/2, dark reddish brown, mode stiff to stiff, trace coarse sand and fine sub-ang angular gravel	erately - ular to _ - -	31.7 2.5	
- - - - - - - - - - - - - - - - - - -	20.0	<u>4.0</u> 4.0	S5	Clay (CL) 16.0-20.0' - 5YR 4/1, dark gray, moist, moderat stiff, moderate plasticity, few to some silt, trace fine sub-angular gravel	iely - sand, _ - - - -	2.3	-



PROJECT NUMBER: 480860

BORING NUMBER: TW-01D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/26/2015 END: 1/26/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clay (CL) 20.0-23.8' - 5YR 4/1 to 4/2, dark gray and dark reddish gray, moist, moderately stiff, slight to Breathing Zone = 0.0-0.4 ppm 20.0 2.4 moderate plasticity, some silt, trace sand, fine to coarse sub-angular gravel <u>3.8</u> 4.0 S6 2.7 24.0 23.8-24.0' - no recovery Set Temporary Well from 24-29 ft bgs Collect sample from 24-29 ft bgs for VOC analysis TW-01D-GW-012715 @ 1400 3.7 Clay (CL) 24.0-26.7' - 5YR 4/1 to 4/2, dark gray and dark 25 reddish gray, moist, moderately stiff, slight to moderate plasticity, some silt, trace sand, fine to coarse sub-angular gravel, gravel lense at 26.2-26.3' S7 $\frac{3.0}{4.0}$ 2.4 Silty Clay (CL) 26.7-27.0' - with rock fragments, gravel/rock fragtments in tip of shoe, gravel/rock fragments 28.0 approximately same diameter as core barrel 1.8 27.0-28.0' - no recovery 28.0-29.0' - no recovery S8 <u>0.0</u> 2.0 Bottom of Boring at 29.0 ft below ground surface Driller: Hit refusal at 29 ft bos 30 30.0 35 40



480860

TW-01S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :			START : 1/27/2015 END : 1/27		2015		LOGGER : R. Clennon	
				SOIL DESCRIPTION				
AND AND	SAMPLE INT	ſERVAL (ft)		DEPTH INTERVAL SOIL NAME LISCS GRO	JUP	ГОG		
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT	T,	₽	(mq	COMMENTS
LEVF			SAMPLER	STRUCTURE, MINERALOGY	OIL	RAF	д) Д	
ПОП		1	(ITFE)	Sandy Silt		0	Ш.	Breathing Zone = $0.3-0.6$ ppm
-		1		0.0-0.9' - 7.5YR 3/3, dark brown, moist, dense	e, little –			
-		I		 clay, fine sand, trace coarse sand and fine gra Silty Sand with gravel 	avel			-
		1		\sim 0.9-1.5' - 7.5YR 6/1, gray, dry, dense, fine to n	nedium			-
-		<u>2.95</u>	S1	sand, little coarse sand, trace fine to coarse sub-angular gravel	/-		1.6	-
-		4.0		Silty Clay (CL)				-
-		1		1.5-2.95' - 7.5YR 3/2, dark brown, stiff, very de	ense, /=			-
_	4.0	I		2.95-4.0' - no recovery	/ -			-
				Clay (CL)	mu atiff		1.5	-
5		1		little silt	ry sun,			
		1						_
_		40	52					-
_		4.0	02				2.7	-
_		1			- F			-
		1			-			_
-	8.0					$\langle\!\!\!\langle A$	20	-
-		1		8.0-12.0' - 7.5YR 4/3, brown, damp to moist, s	tiff to		2.8	-
-		1		very stiff, little silt	-			-
		1						-
10		$\frac{4.0}{4.0}$	S3				177.0	
		4.0			- F			-
-		1			-			-
-	12.0	1						-
-	12.0			Clay (CL)			37.8	-
		1		12.0-16.0' - 7.5 YR 3/3 to 5YR 4/2, dark brown reddish brown, damp to moist, stiff to medium	stiff			-
		1		(decreases with depth), slight plasticity, trace t	to little			_
		4.0	S4	Sill, trace coarse sand				
		4.0	04				20.2	_
15		1			_			
		1			-			Collect sample from 15-20 ft bgs for -
-	16.0					\square	26	VOC analysis
		1		16.0-20.0' - 7.5YR 4/2 to 3/2, brown to dark br	own, –		2.0	
-		1		moist, stiff to medium stiff, few to some silt, tra	ace			-
		1						-
-		$\frac{4.0}{4.0}$	S5		-		1.3	-
-		4.0			-			-
-		1			-			-
20	20.0	I					1.0	-
	20.0			Bottom of Boring at 20.0 ft below ground surfa	ice	<u> </u>		
		1						



TW-02D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WAT	FRI	FV	FIS	
**/ \ \		v	LLO	

WATER LEVELS :			START : 1/27/2015 E	END : 1/27/2	2015		LOGGER : R. Clennon	
				SOIL DESCRIPTION				
DEPTH BELOW SURFACE AND ELEVATION (ft)	SAMPLE INT	FERVAL (ft)	(ft) SAMPLER (TYPE)	DEPTH INTERVAL, SOIL NAME, USCS GROU SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOI STRUCTURE, MINERALOGY	P L	GRAPHIC LOG	PID (ppm)	COMMENTS
	4.0	<u>2.85</u> 4.0	S1	Fill 0.0-0.5' - Organics, topsoil, gravel Sandy Silt 0.5-1.3' - 10YR 4/3 to 4/4, brown to dark yellowis brown, moist, dense, fine sand, trace coarse sar fine gravel Silt (SM) 1.3-1.6' - 7.5YR 3/2, dark brown, moist, dense, li clay Clay (CL) 1.6-2.85' - 10YR 4/3 transitioning to 7.5YR 4/3, b to brown, moist, your stiff, little to fow silt	sh - nd and - ittle - prown -		0.3 0.2	Breathing Zone = 0.0 ppm - - - - - - -
5	80	<u>4.0</u> 4.0	S2	2.85-4.0' - no recovery Clay (CL) 4.0-8.0' - 7.5YR 4/4 to 4/6, brown to strong brown damp to moist, very stiff, little silt	n, -		0.7	- - - - - - - - - - -
 10 	12.0	<u>4.0</u> 4.0	S3	Clay (CL) 8.0-12.0' - 7.5YR 4/3, brown, damp to moist, stiff silt	f, little - - - - - -		2.4	- - - - - - - - - - - - - - -
 15	16.0	<u>4.0</u> 4.0	S4	Clay (CL) 12.0-16.0' - 7.5YR 4/2, brown, moist, moderately little plasticity, with little dark gray 7.5YR 4/1 in 15.5-16.0', few silt	/ stiff,		2.3	- - - - - - - - - - -
	20.0	<u>4.0</u> 4.0	S5	Clay (CL) 16.0-20.0' - 7.5YR 4/2 and 5YR 4/2, brown and c reddish brown, moist, moderately stiff, little to so plasticity, some silt, trace fine to coarse sub-ang gravel	Jark - me _ ular - - -		0.8	



TW-02D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/27/2015 END: 1/27/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clay (CL) 20.0-24.0' - 5YR 4/2, dark reddish bray, moist, 0.6 20.0 moderately stiff, little to some plasticity, some silt, trace fine to coarse sub-angular gravel <u>4.0</u> 4.0 S6 0.5 24.0 Clay (CL) 0.4 24.0-24.45' - 5YR 4/2, dark reddish bray, moist, moderately stiff, little to some plasticity, some silt, trace fine to coarse sub-angular gravel 25 Set Temporary Well from 25-30 ft bgs **Rock/Gravel fragments** Collect sample from 25-30 ft bgs for 24.45-24.6' VOC analysis S7 <u>1.0</u> 4 0 TW-02D-GW-012715 @ 1640 Silty Clay (CL) 24.6-25.0' - 5YR 4/2, dark reddish gray, moderately stiff to moderately soft, low to medium plasticity, trace 0.6 coarse sand and fine gravel 25.0-28.0' - no recovery 28.0 Silty Clay (CL) 28.0-28.35' - 5YR 4/2, dark reddish gray, moderately stiff to moderately soft, low to medium plasticity, trace S8 0.35 2.0 coarse sand and fine gravel 28.35-30.0' - no recovery 30 30.0 Bottom of Boring at 30.0 ft below ground surface 35 40



TW-02S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/27/2015 END: 1/27/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 00 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Breathing Zone = 0.0 ppm Silt (SM) 0.0-0.4' - 10YR 2/2, very dark brown, damp, dense, trace to little organics Sandy Silt (SP-SM) 0.4-1.3' - 10YR 3/3 and 4/3, dark brown and brown, damp to moist, firm to strong, trace to little coarse <u>2.72</u> 4.0 S1 0.5 sand and fine to coarse sub-angular gravel, trace strong brown (7.5YR 5/8) coarse sand Silty Sand (SP-SM) 1.3-1.9' - 10YR 4/3, brown, moist, dense, fine sand, trace to little fine to coarse sub-angular to angular 4.0 gravel, gravel to 0.12' diameter 0.6 Clay (CL) 1.9-2.72' - 10YR 4/3, brown, damp to moist, very stiff to stiff, little silt 5 2.72-4.0' - no recovery Clay (CL) S2 <u>4.0</u> 4.0 4.0-8.0' - 7.5YR 4/4, brown, damp to moist, very stiff, 1.0 little silt 8.0 Clay (CL) 0.5 8.0-12.0' - 7.5YR 4/3, brown, damp to moist, stiff to medium stiff (decreasing in 11-12'), trace to little silt, trace coarse sand 10 $\frac{4.0}{4.0}$ S3 0.5 12.0 0.1 Clay (CL) 12.0-16.0' - 7.5YR 3/3 to 3/2 with 5YR 3/3, dark brown with dark reddish brown, moist, moderately stiff, slight plasticity, little silt, trace coarse sand <u>4.0</u> 4.0 S4 0.1 15 Set Temporary Well from 15-20 ft bgs Collect sample from 15-20 ft bgs for 16.0 VOC analysis Clay (CL) 0.1 TW-02S-GW-012815 @ 1445 16.0-20.0' - 7.5YR 4/2 to 5YR 4/2, brown to dark reddish brown, moist, moderately stiff, low plasticity, some silt, trace coase sand, fine sub-angular gravel **S**5 <u>4.0</u> 4 0 0.1 0.0 20 20.0 Bottom of Boring at 20.0 ft below ground surface


PROJECT NUMBER: BORING NUMBER: 480860 **TW-03D**

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/27/2015 END: 1/27/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē 0.0-0.1' - Gravel fragments, organics Breathing Zone = 0.0 ppm Sandy Silt (SP-SM) 0.1-2.88' - 10YR 3/3, dark brown, moist to wet, dense, fine to medium sand, trace to little coarse sand and fine to coarse sub-angular gravel, little clay <u>2.88</u> 4.0 S1 1.3 2.88-4.0' - no recovery 4.0 Sandy Silt (SP-SM) 1.0 4.0-4.5' - 10YR 3/3, dark brown, wet, soft, dense, fine to medium sand, trace to little coarse sand and fine to coarse sub-angular gravel, little clay 5 4.5-8.0' - no recovery S2 <u>0.5</u> 4 0 8.0 8.0-12.0' - no recovery 10 0.0 S3 4.0 12.0 12.0-16.0' - no recovery Breathing Zone = 0.0 ppm <u>0.0</u> 4.0 S4 15 16.0 Sandy Silt (SM) 16.0-16.65' - 10YR 4/2, dark grayish brown, wet, soft, medium dense, few to some clay, trace coarse sand and fine gravel Silty Clay (CL) 16.65-18.7' - 10YR 4/2 to 3/2, dark grayish brown to very dark grayish brown, moist to wet, stiff, moderate institution fine to coarse gravel (sub-angular to S5 <u>2.7</u> 4.0 1.0 plasticity, trace fine to coarse gravel (sub-angular to sub-round) 18.7-20.0' - no recovery 20.0 20



TW-03D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/27/2015 END: 1/27/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clay (CL) 20.0-24.0' - 7.5YR 4/2 to 5YR 4/2, brown to dark 20.0 1.0 reddish gray, wet, stiff, some silt, trace coarse sand and fine gravel <u>4.0</u> 4.0 S6 1.1 24.0 Clay (CL) 2.2 Breathing Zone = 0.0 ppm 24.0-27.75' - 7.5YR 4/2 to 5YR 4/2, brown to dark Set Temporary Well from 24.5-29.5 ft 25 reddish gray, wet, stiff, some silt, trace coarse sand bgs and fine gravel Collect sample from 24.5-29.5 ft bgs for VOC anaylsis TW-03D-GW-012715 @ 1730 S7 <u>3.75</u> 4.0 0.2 28.0 27.75-28.0' - no recovery 0.6 Clay (CL) 28.0-29.15' - 7.5YR 4/2 to 5YR 4/2, brown to dark <u>1.15</u> 1.5 S8 reddish gray, wet, stiff, some silt, trace coarse sand 27.0 Driller: Hit refusal at 29.5 ft bgs and fine gravel 29.5 29.15-29.5' - no recovery 30 Bottom of Boring at 29.5 ft below ground surface 35 40



TW-03S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	'ELS :			START : 1/27/2015	END : 1/27	/201	5	LOGGER : R. Clennon
				SOIL DESCRIPTION				
	SAMPLE INT	FERVAL (ft)		DEPTH INTERVAL SOIL NAME LISCS GR	JUP	LOG		
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTEN	Т,	ΗC	(mq	COMMENTS
EVA			SAMPLER	RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE. MINERALOGY	SOIL	RAP	D (p	
ESE			(TYPE)	0-m-h- 0:(4 (0M)		С П. П.	đ	Desething Zenze 0.0 men
				0.0-1.3' - 10YR 3/3. dark brown, wet, dense, f	ine to -			Breatning Zone = 0.0 ppm
				medium sand, trace fine to coarse gravel	_			_
				Sandy Sitl (SM)	-		2.4	_
		2.3	S1	1.3-2.3' - 10YR 3/3, dark brown, wet, dense, f	ine to			_
		4.0	_	2 3-4 0' - no recovery		1.1.1		_
				2.0 4.0 10 10000019				_
					_		1.8	-
	4.0							-
				4.0-8.0' - no recovery	_			_
5								
					_			-
		0.0	S2		_			-
		4.0	02		_			-
					_			-
					_			_
	8.0							-
				8.0-12.0' - minimal to no recovery Recovered material is "slurry" of water, with s	andv -			-
				gravel				-
					_			_
10		0.0	63					
		4.0	- 35					
	12.0							
				Gravel and Sand		///		
				\neg poorly sorted				
				Clay (CL)	/		4.0	
		0.02	64	12.2-12.93' - 7.5YR 4/2 to 3/2, brown to dark I wet stiff little silt	prown,			
		4.0	- 54	12.93-16.0' - no recovery				
15								
								Set Temporary Well from 15-20 ft bgs
1	16.0							VOC analysis
				Silty Clay (CL)		///		TW-03S-ĠW-012815 @ 1720
				reddish gray, wet, stiff to moderately stiff, slig	ht to			
1				moderate plasticity, trace fine to coarse sand,	trace	V//	5.7	_
1		4.0	0.5	ine to coarse sub-round to sub-angular grave		V//		-
1		4.0 4.0	30					-
1						V//		-
1						///	3.4	-
20	20.0							
				Bottom of Boring at 20.0 ft below ground surfa	ace			



480860

ING NUMBER: TW-04D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	/ELS :			START : 1/29/2015 EN	ID : 1/29/	201	5	LOGGER : R. Clennon
				SOIL DESCRIPTION				
⋛₽€	SAMPLE IN	FERVAL (ft)				90		
N A B	-		(4)	DEPTH INTERVAL, SOIL NAME, USCS GROUP		С С	Ê	COMMENTS
E E E		RECOVERT	(it)	RELATIVE DENSITY OR CONSISTENCY, SOIL		Ηď	(ppr	COMMENTS
			SAMPLER (TYPE)	STRUCTURE, MINERALOGY		BRA	Ģ	
ПОП			(111)	Sandy Silt (MI)		111	ш.	Coologist Noto: Unable to cololet
-	-			0.0-1.7' - 10YR 4/3 brown moist to wet moderate	lv –			ambient PID readings due to rain/snow
_				dense, little fine to coarse sand, trace to little clay				
-	1			Silty Condwith group (SM)		·		-
	1	<u>3.8</u>	S1	1 7-2 4' - 10YR 3/2 very dark gravish brown wet	-		36.8	-
	-	4.0		☐ moderately dense, fine to coarse angular gravel, fine to	ine /=			-
-	-			\to medium sand	/ -	[]]]		-
_				Silty Clay (SC)	_			_
	4.0			2.4-3.05 - 7.51 R 4/2 and 4/3, brown, moist, still to	, 一	///		
-				3.85-4' - no recovery	—⁄_	///	0.0	-
				Silty Clay (CL)	/ _			-
°				4.0-8.0' - 7.5YR 4/4, brown, moist, stiff to very stiff				
	-				-			-
_		40	S2		_			-
		4.0	02				0.0	
-	1				_			-
-	1				-			-
	-				-			-
	8.0					///		-
_				Clay (CL) 8.0-12.0' - 5YR 4/3 brown stiff - decreasing with	_		80.0	_
				depth, transitions to 7.5YR 4/2 in 10.7-12', some s	ilt			
-	1				_			-
10					-			-
10		<u>4.0</u>	S3				30.6	
		4.0			-		00.0	-
_					_			_
-	12.0				_			-
	12.0			Clay (CL)	-	///	4.2	-
	-			12.0-16.0' - 7.5YR 4/2, brown, moist to wet, stiff to	-			-
-	-			moderately soft, some silt	-			-
_					_			-
		4.0	64					
-		$\frac{4.0}{4.0}$	- 54				0.0	-
15	1				-			-
10_	-							
	-				-			-
- 1	16.0					///		-
_				Liay (CL) 16.0.20.0' 5VP 4/2 moist to wet stiff to moderat	olv –		1.3	_
				soft, trace fine to coarse sub-angular gravel, some	e silt			
-	1			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	_			-
	1				-			-
-	-	<u>4.0</u>	S5		-		44 4	-
-	-	4.0			_		1	-
_								
20	20.0				-		1	-
	20.0						1	



TW-04D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 1/29/2015 END: 1/29/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Silty Clay (CL) 20.0-24.0' - 7.5YR 4/2, brown, moist to wet, soft to 20.0 18.2 moderately soft, slight plasticity, trace fine to coarse sub-round to sub-angular gravel S6 <u>4.0</u> 4.0 0.0 24.0 Silty Clay (CL) 11.5 24.0-27.9' - 7.5YR 4/2, brown, moist to wet, soft to moderately soft, slight plasticity, trace fine to coarse sub-round to sub-angular gravel Set Temporary Well from 24.5-29.5 ft 25 bgs Collect sample from 24.5-29.5 ft bgs for VOC analysis TW-04D-GW-013015 @ 1000 S7 <u>3.9</u> 4 0 0.0 28.0 27.9-28.0' - no recovery 0.0 Silty Clay (CL) 28.0-29.5' - 5YR to 7.5YR 4/2, brown, moist to wet, soft to moderately soft, slight plasticity, trace fine to S8 <u>1.5</u> 1.5 Driller: Hit refusal at 29.5 ft bos 29.5 coarse sub-round to sub-angular gravel Bottom of Boring at 29.5 ft below ground surface 30 35 40



PROJECT NUMBER: BORING NUMBER: 480860 **TW-05D**

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/3/2015 END: 2/3/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Crushed Gravel and Sand Breathing Zone = 0.0-3.0 ppm 0.0-2.0' - light gray to dark gray, mixture, 0.5-1.0" in size <u>3.0</u> 4.0 S1 2.1 Silty Lean Clay (CL) 2.0-8.0' - light brown, with little to trace gravel, dry but not hard, very little moisture, gravel embedded inside CL about 0.25" in size 4.0 2.2 5 S2 $\frac{4.0}{4.0}$ 1.0 8.0 Silty Lean Clay (CL) 0.8 8.0-12.0' - strong brown, slightly moist, with little to trace gravel 10 4.0 S3 5.3 4.0 12.0 Silty Lean Clay (CL) 35.1 12.0-16.0' - strong brown, moist to wet, with little to trace gravel, gravel clast up to 0.5" in size <u>4.0</u> 4.0 S4 36.0 15 16.0 Silty Lean Clay (CL) 5.1 16.0-20.0' - strong dark brown, wet, with little gravel and sand mixed in S5 $\frac{4.0}{4.0}$ 4.9 20.0 20



TW-05D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/3/2015 END: 2/3/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Silty Lean Clay (CL) 20.0 1.2 20.0-20.5' - strong dark brown, wet, with little gravel \and sand mixed in 20.5-24.0' - no recovery <u>0.5</u> 4.0 S6 Set Temporary Well from 22.3-27.3 ft bgs Collect sample from 22.3-27.3 ft bgs for VOC analysis 24.0 TW-05D-GW-020415 @ 1030 Silty Lean Clay (CL) 0.7 24.0-28.0' - strong dark brown, slightly moist, with little gravel and sand mixed in, increase in amount and size of gravel clast up to 0.75" size 25 S7 $\frac{4.0}{4.0}$ 6.2 28.0 Lean Clay (CL) 28.0-30.0' - strong brown, slightly moist, less embedded gravel clast 5.3 S8 <u>2.0</u> 2.0 20.2 30 30.0 Bottom of Boring at 30.0 ft below ground surface 35 40



PROJECT NUMBER: BORING NUMBER: 480860 TW-05S SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/3/2015 END: 2/3/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Crushed Gravel and Sand Breathing Zone = 0.0-0.3 ppm 0.0-2.0' - light gray to dark gray, 0.5-1.0" in size <u>4.0</u> 4.0 S1 Silty Lean Clay (CL) 2.0-8.0' - light brown, with little to trace gravel, dry but not hard, very little moisture, gravel (rounded) 0.9 embedded inside lean clay about 0.25" in size 4.0 0.0 5 <u>4.0</u> 4.0 S2 0.8 8.0 Silty Lean Clay (CL) 0.8 8.0-12.0' - strong brown, lightly moist, with little to trace gravel 10 <u>4.0</u> 4.0 S3 0.0 12.0 Silty Lean Clay (CL) 0.0 12.0-16.0' - strong brown, moist to wet, with little to trace gravel, embedded gravel clast up to 0.5" in size <u>4.0</u> 4.0 S4 1.7 15 Set Temporary Well from 14.8-19.8 ft bgs Collect sample from 14.8-19.8 ft bgs 16.0 for VOC analysis Silty Lean Clay (CL) 0.6 TW-05S-GW-020415 @ 1000 16.0-20.0' - strong dark brown, wet, with little gravel and sand mixed $\frac{4.0}{4.0}$ **S**5 0.0 0.0 20 20.0 Bottom of Boring at 20.0 ft below ground surface



480860

TW-06D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	′ELS :			START : 1/30/2015	END : 1/30/20	15	LOGGER : R. Clennon
				SOIL DESCRIPTION			
AND AND	SAMPLE INT	ſERVAL (ft)		DEPTH INTERVAL SOIL NAME USCS GRO	OUP OU		
ACE		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT	T, 일	(md	COMMENTS
EVA EVA		ļ	SAMPLER	STRUCTURE, MINERALOGY	DIL AN	d) D	
ESE			(TYPE)	Sandy Silt (SM)	0	<u> </u>	Prosthing Zono = 0.0 nnm
-				0.0-1.1' - 10YR 2/2 to 2/1, very dark brown to v	very -		Breatning Zone = 0.0 ppm
_				dark grayish brown, damp, dense, fine sand, tr	race to		_
_							_
_		3.45	S1	Silt (SM)	/		_
_		4.0		1.1-1.7' - 10YR 2/2 to 2/1, very dark brown to to moist dense to very dense, some fine sand tr	black,	2.5	_
_				coarse sand			_
_				Silty Clay (CL)		4	_
_	4.0			1.7-5.45 - 10 FR 4/4 to 7.5 FR 4/4, brown, dam			_
_				3.45-4.0' - no recovery		2.1	_
5				Clay (CL) 4 0-7 6' - 7 5YR 4/4 brown damp to moist sti	ff to		
_				very stiff, some silt, non-plastic			_
_		3.6	\$2				
_		<u>4.0</u>	52			6.4	
	8.0			7.6-8.0' - no recovery	7//	1	
				Clay (CL)	tiff to	9.1	
_				very stiff, some silt, with trace fine angular to			
_				sub-angular gravel, non-plastic			_
10			00				-
		<u>3.9</u> 4.0	53			7.7	
_							-
_						1	-
-	12.0						-
-	12.0			11.9-12.0' - no recovery		8.1	-
-				Clay (CL) 12.0-14.0' - 7.5YR 4/3 and 4/4. brown. moist. s	stiff to		-
-	1			moderately stiff, some silt, transitioning to 7.51	YR 4/2	1	-
-	1			in 13.5-14', trace fine sub-angular gravel			-
-	1	$\frac{4.0}{4.0}$	S4	Clay (CL)		1.9	-
15	1	4.0		14.0-16.0' - 7.5YR 4/2, brown, moderately soft	i, some		-
15	1			sub-angular gravel			
-	16.0						-
-	10.0			Silty Clay (CL)		3.1	-
-				16.0-20.0' - 7.5YR 4/2, brown, moderately soft	to soft,		-
-				coarse sub-angular gravel			-
-							-
-		$\frac{4.0}{4.0}$	S5			2.5	-
-		4.0					-
-					-//		-
							-
20	20.0					4—	
						1	



480860

TW-06D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEVELS :				START : 1/30/2015 END : 1/30/20		2015	5	LOGGER : R. Clennon
				SOIL DESCRIPTION				
LOW AND (ft)	SAMPLE INT	FERVAL (ft)		DEPTH INTERVAL SOIL NAME LISCS GROUP	Р	LOG		
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT,		Ч	(mq	COMMENTS
EPTH LEVA			SAMPLER	RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	L	RAP	d) D	
	20.0		(TYPE)	Silty Clay (CL)			_ 2.4	
-	20.0			20.0-23.9' - 7.5YR 4/2, brown, moderately soft to	soft, -		2.4	-
-				some silt, stiffness decreasing with depth, trace f	fine to	$\parallel \mid$		-
-					-	\square		-
-		<u>3.9</u>	S6				20	-
-		4.0			-	\square	2.0	-
-					-			-
-					-	\square		-
-	24.0			23.9-24.0' - no recovery		 []]]	2.2	-
				Silty Clay (CL)	-			-
25				some silt, stiffness decreasing with depth, trace f	fine to			Set Temporary Well from 25-30 ft bas
-				coarse sub-angular gravel, little to few angular gr	ravel -			Collect sample from 25-30 ft bgs for
-		<u>3.3</u>	S7	11 27-23	-		1.9	TW-06D-GW-020415 @ 0900
-		4.0			-			
-					-			-
-	28.0			27.3-28.0' - no recovery	-			-
-	20.0			Silty Clay (CL)			2.2	-
_				28.0-30.0' - 7.5YR 4/2, brown, moderately soft to some silt stiffness decreasing with depth trace f	soft, -			-
_		<u>2.0</u> 2.0	S8	coarse sub-angular gravel		$\parallel \mid$		-
30	30.0	2.0			1		2.1	-
				Bottom of Boring at 30.0 ft below ground surface	;			
_					-			-
]							-
_					_			_
_					_			-
_					_			-
_					_			-
_					_			-
35								_
-					-			-
-					-			-
-					-			-
-					-			-
-					-			-
-					-			-
-	-				-			-
-					-			-
40					-			-
40								



TW-06S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEVELS :				START : 1/30/2015 END : 1/	30/201	5	LOGGER : R. Clennon
200				SOIL DESCRIPTION			
ELOW AND N (ft)	SAMPLE INT	ERVAL (ft)		DEPTH INTERVAL, SOIL NAME, USCS GROUP			
FACE		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL	DHIC	mqq)	COMMENTS
DEP' SURI ELEV			SAMPLER (TYPE)	STRUCTURE, MINERALOGY	GRA	DIA	
_				Silt (SM)			Breathing Zone = 0.0 ppm
_				fine sand, trace to little coarse sand and fine			_
-				\sub-angular gravel	, K		-
_		<u>3.15</u>	S1	0.65-1.55' - 10YR 2/2 and 3/2, dark brown to brown,	-	1.1	-
_		4.0		gravel	-///		-
-				L Clay (CL)	<i>_¥[[]</i>		-
_	4.0			3.15-4.0' - no recovery			
_				Clay (CL) 4.0-7.9' - 7.5YR 4/4, brown, damp, stiff to very stiff,		1.1	_
5				some silt	-///		
-					-///		-
-		<u>3.9</u> 4 0	S2			2.7	-
-							-
							_
_	8.0			7 9-8 0' - no recovery		2.0	_
-				Clay (CL)	-///	2.9	_
-				stiff, transitioning to 7.5YR 4/2 in 11-12', some silt,	-///		-
10				trace coarse sand, stiffness decreases with depth			-
		<u>4.0</u> 4.0	\$3			2.3	
-							_
-					-///		-
-	12.0			Clav (CL)		7.2	-
-				12.0-16.0' - 7.5YR 4/3 and 4/4, brown, moist,			-
-				stiffness decreasing with depth			-
		40	<u>S4</u>				_
-		4.0	01		-///	0.8	_
15					-///		Set Temporary Well from 15-20 ft bos
-	16.0						Collect sample from 15-20 ft bgs for
_	10.0			Silty Clay (CL)		0.7	TW-06S-GW-020415 @ 0830
_				16.0-20.0' - 7.5YR 4/2, brown, moist, moderately soft to soft, trace fine sub-angular gravel			-
-							_
		<u>4.0</u>	S5			10	-
-		4.0			-///	1.0	-
-							-
20	20.0					1.0	
				Bottom of Boring at 20.0 ft below ground surface			



PROJECT NUMBER: BORING NUMBER: 480860 TW-07D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	′ELS :			START : 2/4/2015	END : 2/4/201	5	LOGGER : J. Burkard
200				SOIL DESCRIPTION			-
	SAMPLE INT	ERVAL (ft)		DEPTH INTERVAL, SOIL NAME, USCS GRO			
H BE		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT RELATIVE DENSITY OR CONSISTENCY. SO		(mqq	COMMENTS
DEPI			SAMPLER (TYPE)	STRUCTURE, MINERALOGY	GRA	PID (
				Gravelly Clay (CL)	(01) :		Breathing Zone = 0.1-0.3 ppm
				size	/2° IN		
_							-
-		3.5	S1				-
-		4.0				0.2	-
-					-//		-
-				3.5-4.0' - no recoverv	//,	4	-
-	4.0			Silty Lean Clay (CL)		0.6	-
5				4.0-10.0' - tan to light brown, dry to slightly moi little to trace glacial gravel inclusions	ist, with		-
Ŭ							
		4.0	62				
_		<u>4.0</u> 4.0	52			0.2	-
-							-
-							-
-	8.0					0.5	-
-					-//	0.0	-
-							-
10							-
		<u>4.0</u> 4.0	S3	Silty Lean Clay (CL)		0.5	
				gravel inclusions which increase with depth			
_							-
-	12.0						-
-					-//	0.6	-
-					- V		-
-					$-\psi$		-
-		<u>4.0</u> 4.0	S4			0.9	-
15		4.0					-
_	16.0						_
-						0.8	-
-							-
-							-
-		<u>4.0</u>	S5		-//	0.5	-
-		4.0					-
-					-		-
20	20.0						-
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PROJECT NUMBER: BORING NUMBER: 480860 TW-07D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEVELS :				START : 2/4/2015	START : 2/4/2015 END : 2/4/2015		
				SOIL DESCRIPTION			
N (ff) N (ff)	SAMPLE INT	ERVAL (ft)		DEPTH INTERVAL. SOIL NAME, USCS (GROUP	2	
A DE ACE		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONT	ENT,		COMMENTS
LEV/			SAMPLER	STRUCTURE, MINERALOGY	, SOIL		
ПОП	20.0		(115)			0.4	
-	20.0						
-							
-							
-		<u>2.0</u>	S6				Cat Tamparan (Wall from 21.4.27.4.ft
-		4.0					bgs
-							Collect sample from 22.1-27.1 ft bgs
-							TW-07D-GW-020415 @ 1100
-	24.0					0.5	
-							-
25							
-							-
-		<u>4.0</u>	S7			0.5	
-		4.0					
-							Driller: Hit refusal at 28.0 ft bos
-						07	
-	28.0			Bottom of Boring at 28.0 ft below ground su	urface	<u>//</u>	
-					-		-
-					-		
30					-		· · · · · · · · · · · · · · · · · · ·
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480860

TW-07S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

20

20.0

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/4/2015 END: 2/4/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Gravelly Clay (CL) Breathing Zone = 0.1-0.3 ppm All headspace readings from 0 to 20 ft bgs were less than 1.0 ppm 0.0-3.5' - black and dark brown, gravel 1/4 to 1/2" in size <u>4.0</u> 4.0 S1 Silty Lean Clay (CL) 4.0 3.5-10.0' - tan to light brown, partially dry to slightly moist, with little to trace gravel inclusions 5 <u>4.0</u> 4.0 S2 8.0 10 <u>4.0</u> 4.0 S3 Silty Lean Clay (CL) 10.0-20.0' - strong brown, moist to wet, with glacial gravel inclusions which increase in depth 12.0 <u>4.0</u> 4.0 S4 15 Set Temporary Well from 14.8-19.8 ft bgs Collect sample from 14.8-19.8 ft bgs for VOC analysis 16.0 TW-07S-GW-020415 @ 1045 $\frac{4.0}{4.0}$ **S**5

Bottom of Boring at 20.0 ft below ground surface



PROJECT NUMBER: BORING NUMBER: 480860 TW-08D SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/4/2015 END: 2/4/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) LOG SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY RECOVERY (ft) GRAPHIC COMMENTS SAMPLER (TYPE) Blind drill down to 30' bgs to set well. Hit refusal at 28.5' bgs. Set temporary well from 23.5-28.5' bgs. 5 10 28.5 15 20



PROJECT NUMBER: BORING NUMBER: 480860 TW-08D SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/4/2015 END: 2/4/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) LOG SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Set Temporary Well from 23.5-28.5 ft bgs Collect sample from 23.5-28.5 ft bgs for VOC analysis TW-08D-GW-013015 @ 1115 25 28.5 Bottom of Boring at 28.5 ft below ground surface 30 35 40



PROJECT NUMBER: BORING NUMBER: 480860 TW-09D SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/4/2015 END: 2/4/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) LOG SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY RECOVERY (ft) GRAPHIC COMMENTS SAMPLER (TYPE) Blind drill down to 30' bgs to set temporary well. Hit refusal at 29.5' bgs. set temporary well from 24.5-29.5' bgs 5 10 15 29.5 20



PROJECT NUMBER: 480860 TW-09D SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 2/4/2015 END: 2/4/2015 LOGGER : J. Burkard SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) LOG SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Set Temporary Well from 24.5-29.5 ft bgs Collect sample from 24.5-29.5 ft bgs for VOC 25 analysis TW-09D-GW-020415 @ 1130 29.5 Bottom of Boring at 29.5 ft below ground surface 30 35 40



480860

TW-10D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	'ELS :			START : 3/31/2015	END : 3/31/2	2015		LOGGER : R. Clennon
200				SOIL DESCRIPTION				
DEPTH BELOV SURFACE AND ELEVATION (ft	SAMPLE INT	rerval (ft) Recovery	(ft) SAMPLER (TYPE)	DEPTH INTERVAL, SOIL NAME, USCS GRO SYMBOL, COLOR, MOISTURE CONTEN RELATIVE DENSITY OR CONSISTENCY, S STRUCTURE, MINERALOGY	OUP T, SOIL	GRAPHIC LOG	PID (ppm)	COMMENTS
		<u>1.8</u> 4.0	S1	Sandy Silt and Gravel (ML) 0.0-0.75' - 10YR 6/2, light brownish gray, wet, organics, poorly sorted Silty Sand (SM) 0.75-1.3' - 10YR 2/2, very dark brown, moist to trace to little gravel, little organics Silty Sand and Silt (SM/ML) 1.3-1.8' - 10YR 5/3, brown, moist, dense 1.8-4.0' - no recovery	few -		0.1	Breathing Zone = 0.0 ppm - - - - -
- 5 - - - -	4.0	<u>3.75</u> 4.0	S2	Silt (ML) 4.0-7.75' - 7.5YR 4/6, strong brown, moist, ver dense, trace medium to coarse sand, trace or	ry - ganics - - - -		0.2	Breathing Zone = 0.0 ppm
- - - 10 - - -	8.0	<u>4.0</u> 4.0	S3	7.75-8.0' - no recovery Clayey Silt (ML) 8.0-12.0' - 7.5YR 4/6 and 5YR 4/4, strong brow reddish brown, moist, very dense, trace mediu coarse sand	wn and - um to - - - -		0.6 0.8	Breathing Zone = 0.0 ppm
- - - - 15 -	16.0	<u>4.0</u> 4.0	S4	Clayey Silt (ML) 12.0-16.0' - 5YR 4/2 to 5YR 3/2, dark reddish dark reddish brown, moist to wet, moderately (decreases with depth), trace organics	gray to - dense _ - - - - -		0.4	Breathing Zone = 0.0 ppm
	20.0	<u>3.5</u> 4.0	S5	Clayey Silt (ML) 16.0-19.5' - 75 YR 4/2 to 10YR 4/2, brown to c grayish brown, saturated to wet, soft, moderat dense, slight plasticity, trace very fine grained trace medium to coarse sand 19.5-20.0' - no recovery	dark – ely – sand, – – –		0.3	Breathing Zone = 0.0 ppm



TW-10D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	/ELS :			START : 3/31/2015END : 3/3	<u>1/201</u>	5	LOGGER : R. Clennon
				SOIL DESCRIPTION			
≥⊡≎					U	└──	
N (INC)	SAMPLE INT	ERVAL (ft)		DEPTH INTERVAL, SOIL NAME. USCS GROUP	2	1	
뿝읪은		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT,	₽	Ê	COMMENTS
H H H				RELATIVE DENSITY OR CONSISTENCY, SOIL	Ę	đ	
			SAMPLER (TYPF)	STRUCTURE, MINERALOGY	3R/	e	
<u> </u>	00.0		()	Clavay Silt (ML/CL)			Broothing Zono = 0.0 mm
	20.0			20.0.21.25 7 5VP 4/2 to 10Vr 4/2 brown to dark		0.3	Breatning Zone = 0.0 ppm
				aravish brown saturated to wet soft moderately	V		
-				dense slight plasticity trace very fine grained sand			
_				trace medium to coarse sand		1	
				21 25-24 0' - no recovery			
-		<u>1.25</u>	S6	21.23-24.0 - Horecovery	-	0.3	· · · · ·
-		4.0			-		
_							Set Temporary Well from 23-28 ft bgs
-					-		Collect sample from 23-28 ft bgs for
_	24.0						VOC analysis
				Clayey Silt/Silty Clay (ML/CL)		0.2	TW-10D-GW-040115 @ 0815
	1			24.0-27.25' - 10YR 4/2, dark grayish brown, wet, soft,		I	· · ·
25	4			moderately dense, slight plasticity, trace fine to coarse	1/		
	J			sanu, trace line to coarse sub-rounded to sub-angular	1.		
				ylavel		I	-
	1	<u>3.25</u>	S7			01	-
_		4.0					.
-	1						Driller: Hit refusal at 28 ft bos
				27.25-28.0' - no recovery	-		
	28.0						
				Bottom of Boring at 28.0 ft below ground surface			
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BORING NUMBER: TW-10S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 3/31/2015 END: 3/31/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Silty Sand with Gravel (SM) Breathing Zone = 0.0 ppm 0.0-0.9' - 10YR 5/2, gravish brown, wet, fine to coarse sub-rounded gravel, trace organics, poorly sorted (0.8-0.9' - brick fragments/debris Silty Sand (SM) 0.9-1.6' - 10YR 2/1 to 10YR 2/2, black to very dark <u>2.5</u> 4 0 S1 0.0 brown, moist to wet, fine to medium grained, trace organics, trace fine to coarse gravel, poorly sorted Silt (ML) 1.6-2.5' - 10YR 5/2, grayish brown, moist, dense, trace organics 4.0 2.5-4.0' - no recovery PID reading not available - no recovery Silt (ML) Breathing Zone = 0.0 ppm 4.0-6.2' - 5YR 4/2 and 7.5 YR 4/6, reddish brown to 5 strong brown, moist, dense, with 10YR 6/2 light brownish gray mottling, trace organics s2 <u>2.2</u> 4.0 0.1 6.2-8.0' - no recovery 8.0 8.0-8.25' - Angular gravel, likely slough PID reading not available - no recovery Silt (ML) Breathing Zone = 0.0 ppm 8.25-11.6' - 7.5Y 4/6 to 5Y 4/4, strong brown to reddish brown, moist to wet, very dense to dense 10 <u>3.6</u> 4.0 S3 1.0 11.6-12.0' - no recovery 12.0 Clayey Silt (ML) 0.8 Breathing Zone = 0.0 ppm 12.0-15.9' - 7YR 3/4 with 10YR 5/4, dark brown with yellowish brown in 14-16', wet, dense to moderate dense (decreasing with depth), trace fine to coarse sub-round to sub-angular gravel, non-plastic <u>3.9</u> 4.0 S4 0.2 15 Set Temporary Well from 23-28 ft bgs Collect sample from 23-28 ft bgs for 16.0 VOC analysis 15.9-16.0' - no recovery TW-10S-GW-040115 @ 0825 0.1 Clayey Silt (ML) Breathing Zone = 0.0 ppm 16.0-20.0' - 10YR 4/2 and 7.5Y 4/2, dark grayish brown and brown, wet, soft, moderately dense, trace fine to coarse sub-round to sub-angular gravel (pieces up to 0.1') **S**5 <u>4.0</u> 4 0 0.2 0.2 20 20.0 Bottom of Boring at 20.0 ft below ground surface



BORING NUMBER: TW-11D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER	WATER LEVELS :			START : 3/31/2015	END: 3/31/201	5	LOGGER : R. Clennon
				SOIL DESCRIPTION			
DEPTH BELOW SURFACE AND	SAMPLE	INTERVAL (ft)	(ft) SAMPLER (TYPE)	DEPTH INTERVAL, SOIL NAME, USCS G SYMBOL, COLOR, MOISTURE CONTE RELATIVE DENSITY OR CONSISTENCY STRUCTURE, MINERALOGY	SROUP ENT, ', SOIL	PID (ppm)	COMMENTS
	 4.0	<u>2.75</u> 4.0	S1	Silty Sand and Gravel with Organics (SM 0.0-0.6' - 10YR 4/2 to 10YR 2/1, dark gravis black, wet, poorly sorted Organics 0.6-1.0' - 10YR 2/1, black, layer Organics, Sand, and Gravel 1.0-1.75' - 10YR 2/1, black, wet, poorly sort Silt (ML) 1.75-2.25' - 10YR 5/2, gravish brown, moist little clay, trace very fine grained sand Silt (ML) 2.25-2.75' - 7.5Y 4/2 with 10YR 6/2, brown 1 light brownish gray mottling, moist, dense, f	and the set of the set	0.4	Breathing Zone = 0.0 ppm
	5 	<u>3.25</u> 4.0	S2	2.75-4.0' - no recovery Clayey Silt (ML) 4.0-7.25' - 7.5Y 4/2 with 10YR 6/2, brown w light brownish gray mottling, moist, dense, t fine grained sand 7.25-8.0' - no recovery	rith trace	0.2	
1	0 12.0	<u>4.0</u> 4.0	S3	 Sand and Gravel 8.0-8.25' - likely slough Clayey Silt (ML) 8.25-12.0' - 7.5YR 4/3 to 5Y 4/3, brown to m brown, moist, dense to very dense, trace very grained sand and fine sub-round to sub-ang gravel, non-plastic 	eddish - ery fine - gular _ - -	0.3	Breathing Zone = 0.0 ppm
1	- - - 5	<u>3.9</u> 4.0	S4	Clayey Silt (ML) 12.0-15.5' - 5YR 4/2 to 10YR 4/2, dark redo transitioning to dark grayish brown, wet to s soft, moderately dense, slight to little plastic fine to very fine grained sand	lish brown - aturated, - bity, trace - - - - -	0.5	Breathing Zone = 0.0 ppm
2	16.0 	<u>3.55</u> 4.0	S5	transitioning to dark grayish brown, wet to soft, slight to little plasticity, trace fine to ver grained sand, with few to some very fine grassand, trace to little fine to coarse gravel Clayey Silt (ML) 16.0-19.55' - 10YR 4/2, dark grayish brown saturated, soft, moderately dense, trace fine fine sand, dry rock flour/gravel lense at 16.5 19.55-20.0' - no recovery	, wet to to very 5-16.7' bgs	0.3	Breathing Zone = 0.0 ppm
	1	1	1				1



TW-11D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

WATER LEV	'ELS :			START : 3/31/2015	END : 3/31	/201	5	LOGGER : R. Clennon
				SOIL DESCRIPTION				
AND AND I (ff)	SAMPLE INT	ERVAL (ft)			ID	00		
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT,		₽	Ê	COMMENTS
PTH RFA EVA			SAMPLER	RELATIVE DENSITY OR CONSISTENCY, SOI	L	API	d)	
DE SU ELL			(TYPE)			ß	I	
	20.0			Clayey Silt (ML)	irated -		0.1	Breathing Zone = 0.0 ppm
				soft, slight to little plasticity, trace to little fine to	liateu,			
				_ coarse sub-angular gravel				
		4.0-		21.25-24.0' - no recovery	-			-
		<u>1.25</u> 4 0	S6		-		0.4	-
		4.0			-			Set Temporary Well from 22.5-27.5 ft
-					-			bgs -
	04.0				-			for VOC analysis
-	24.0			_ 24.0-24.25' - slough				TW-11D-GW-040115 @ 0835 -
-				24.25-27.5' - no recovery				-
25								
-					-			-
- 1		<u>0.25</u> 3.5	S7		-			-
-		0.0			-			
					-			Driller: Encountered gravel at 27.5 ft
	27.5				_			
				Bottom of Boring at 27.5 ft below ground surface				
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30					-			-
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					-	1		-
40					-			-
40								



BORING NUMBER: **TW-11S**

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATERIEVELS

WATER LEV	ELS :			START : 3/31/2015 END : 3/31/2015 LOGGER : R. Clennon		
				SOIL DESCRIPTION		
AND (ff)	SAMPLE INT	ERVAL (ft)				
ACE ACE		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT,		
LEV/			SAMPLER	STRUCTURE, MINERALOGY		
			(TYPE)	D Topsoil Organics $-XX$ Breating Zone = 0.0 npm		
-						
-				Sand and Gravel (SW)		
-				\Box coarse grained, fine to coarse sub-angular to		
-		<u>1.75</u>	S1	Sand with Gravel, SMD		
-		4.0		0.4-1.55' - 10YR 7/2, dark grayish brown, wet, fine to		
				medium sand, little silt, fine to coarse sub-angular		
]	4.0			Silt (ML)		
				Breating Zone = 0.0 ppm		
5				trace coarse sand		
_				1.75-4.0' - no recovery		
-		3 <u>.5</u>	S2			
-		4.0		4.25-7.5' - 7.5YR 4/2 to 5YR 5/3, brown to reddish		
-				brown mottling, trace fine to coarse sub-round to		
-				sub-angular gravel, non-plastic		
-	8.0			Clavev Silt (ML) 0.5 Breating Zone = 0.0 ppm		
-				8.0-12.0' - 7.5YR 4/2 to 5YR 5/3, brown to reddish		
-				brown mottling, trace fine to coarse sub-round to		
10				sub-angular gravel, density increases slightly with		
		<u>4.0</u> 4.0	S3			
]]]		
_						
-	12.0					
_				Clayey Silt (ML) 0.2 Breating Zone = 0.0 ppm 12.0-15.9' - 7.5YR 4/3 to 10YR 4/2. brown - - 0.2 Breating Zone = 0.0 ppm		
-				transitioning to dark gravish brown in 13-14', wet to		
-				plasticity, trace fine to coarse sub-round to		
-		<u>3.9</u>	S4	sub-angular gravel		
		4.0				
15				Set Temporary Well TW-11S from 15-		
-	16.0			- 20 ft bgs Collect sample from 15 20 ft bgs for		
-	10.0			15.9-16.0' - no recovery 0.0 VOC analysis		
-				Clayey Silt (ML) TW-11S-GW-040115 @ 0842		
-				transitioning to dark grayish brown in 13-14', wet to		
]		0.8	S 5	plasticity, trace fine to coarse sub-round to		
_		<u>0.0</u> 4.0		sub-angular gravel 0.3		
_						
_						
20	20.0			Bottom of Boring at 20.0 ft below ground surface		
		1				



BORING NUMBER: **TW-12D**

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

		<u>.</u> .
WAIER	LEVEL	э.

WATER LEVELS :		START : 3/31/2015 END : 3/31/		1/201	015 LOGGER : R. Clennon					
				SOIL DESCRIPTION						
H BELOW ACE AND ATION (ft)	SAMPLE INT	ERVAL (ft) RECOVERY	(ft)	ſ	DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, DEL ATM/C DENSITY OF CONCISTENCY, SOIL		PHIC LOG	(mq	COMMENTS	
DEPTI SURF, ELEV/			SAMPLER (TYPE)		STRUCTURE, MINERALOGY	JIL	GRAF	d) CII d		
	4.0	<u>1.7</u> 4.0	S1		Sandy and Gravel (GW) 0.0-0.65' - 10YR 4/4 and 10YR 4/2, dark yellow brown and dark grayish brown, wet, dense, little fine to coarse sub-angular to angular gravel, fine medium sand, little debris (brick) Silt (ML) 0.65-1.0' - 10YR 2/1 to 2/2, balck to very dark to moist, dense, trace to little fine to coarse sand, clay, trace fine gravel Clayey Silt (ML) 1.0-1.7' - 7.5YR 4/2 to 3/2, brown to dark brown moist, very dense to dense, with trace 10YR 2/	vish e silt, ne to prown, few n, 1 black		0.4	Breathing Zone = 0.0 ppm - - - - - - -	
5	0	<u>3.8</u> 4.0	S2		mottling/organics, trace medium to coarse san 1.7-4.0' - no recovery Clayey Silt (ML) 4.0-7.8' - 7.5YR 4/4, brown, moist, very dense dense, trace medium to coarse sand	d/		0.5	Breathing Zone = 0.0 ppm No PID reading - no recovery - 	
	0.0	<u>3.0</u> 4.0	S3		7.8-8.0' - no recovery Clayey Silt (ML) 8.0-11.0' - 7.5YR 4/3, brown, moist, dense to v dense, trace gray (10YR 6/2 light brownish gra mottling, trace coarse sand and fine gravel 11.0-12.0' - no recovery	ery y) -		2.0	Breathing Zone = 0.0 ppm - - - - - - - - - - - -	
- - - - 15	12.0	<u>4.0</u> 4.0	S4		Clayey Silt (ML) 12.0-16.0' - 7.5YR 3/2 to 10YR 4/2, dark brown transitioning to dark grayish brown in 14-16', m moderately dense (decreasing with depth), slig plasticity, trace to little 10YR 5/6 yellowish brow mottling, trace coarse sand and fine to coarse sub-angular gravel	n - ioist, _ ht		4.9	Breathing Zone = 0.0 ppm	
	20.0	<u>4.0</u> 4.0	S5		Clayey Silt (ML) 16.0-20.0' - 10YR 4/2 and 7.5Y 4/2, dark gravis brown and brown, moist, moderately dense to o little plasticity, trace to little fine to coarse sub-r gravel	sh - dense, - round - -		3.5 0.2	Breathing Zone = 0.0 ppm - - - - - -	
							1			



BORING NUMBER: TW-12D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 3/31/2015 END: 3/31/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Silt (ML) 0.2 Breathing Zone = 0.0 ppm 20.0 20.0-24.0' - 10YR 4/2 and 7.5Y 4/2, dark grayish brown and brown, moist, soft, moderately dense to dense, little plasticity, trace to little fine to coarse sub-round gravel, increasing plasticity <u>4.0</u> 4.0 S6 0.1 Set Temporary Well TW-12D from 22.5-27.5 ft bgs Collect sample from 22.5-27.5 ft bgs for VOC analysis 24.0 TW-12D-GW-040115@0850 Clayey Silt (ML) 0.1 Breathing Zone = 0.0 ppm 24.0-27.5' - 10YR 3/3 and 4/2, dark brown and dark gravish brown, moist to wet, soft, moderately dense, slight to no plasticity, trace to little fine to coarse 25 sub-angular gravel, some fine to very fine sand S7 <u>3.5</u> 3.5 0.1 Driller: Hit refusal at 27.5 ft bgs 0.2 27.5 Bottom of Boring at 27.5 ft below ground surface 30 35 40



TW-12S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/1/2015 END: 4/1/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Silty Sand and Gravel (SM) Breathing Zone = 0.0 ppm 0.0-1.4' - 10YR 4/3 to 10YR 4/4, brown transitioning to dark yellowish brown, wet, fine to coarse sub-round to sub-agnular gravel, poorly sorted Silt (ML) 1.4-1.6' - 10YR 2/2, very dark brown, dense, trace clay and very fine grained sand <u>2.75</u> 4 0 S1 0.5 Silt (ML) 1.6-2.75' - 10YR 4/2 to 7.5Y 4/4, dark grayish brown transitioning to brown in 2-2.75', moist to damp, very dense, few to some clay, trace coarse sand and fine 4.0 gravel, non-plastic Breathing Zone = 0.0 ppm 02 2.75-4.0' - no recovery 4.0-4.65' - slough from above, sand and gravel 5 Silt (ML) 4.65-7.55' - 7.5Y 4/4 to 4/6, brown to strong brown, damp to moist, very dense, slight plasticity, few to <u>3.55</u> 4.0 S2 0.5 some clay 7.55-8.0' - no recovery 8.0 Clayey Silt (ML) Breathing Zone = 0.0 ppm 0.6 8.0-12.0' - 7.5YR 4/3, brown, moist, very dense, trace coarse sand and fine gravel 10 $\frac{4.0}{4.0}$ S3 1.0 12.0 Clayey Silt (ML) 6.3 Breathing Zone = 0.0 ppm 12.0-15.75' - 7.5YR 3/2 to 3/4, dark brown, moist to wet, soft, moderately dense, little plasticity <u>3.75</u> 4.0 S4 4.3 15 Set Temporary Well from 15-20 ft bgs Collect Sample from 15-20 ft bgs for 16.0 VOC analysis 15.75-16.0' - no recovery 1.3 TW-12S-GW-040115 @ 1245 Clayey Silt (ML) 16.0-19.6' - 7.5Y 4/2 to 3/2, brown to dark brown, wet, Breathing Zone = 0.0 ppm soft, moderately dense, little plasticity, trace to little fine to coarse sub-round to sub-angular gravel, trace coarse sand **S**5 <u>3.6</u> 4 0 0.2 19.6-20.0' - no recovery 0.1 20 20.0 Bottom of Boring at 20.0 ft below ground surface



BORING NUMBER: TW-13D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/1/2015 END: 4/1/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER STRUCTURE, MINERALOGY 멉 (TYPE) Sand and Gravel (GW) •• •• Breathing Zone = 0.0 ppm 0.0-0.8' - 10YR 4/2, dark grayish brown, dense, fine to coarse sand, fine to coarse sub-angular to angular Î Î gravel, trace debris (brick), poorly sorted Sitly Sand (SP-SM) 0.8-1.15' - 10YR 4/6 and 10 YR 2/2, dark yellowish <u>2.1</u> 4.0 S1 1.3 brown mottled with very dark brown, moist to wet, dense, some silt, trace coarse sand and fine gravel Sand (SP) 1.15-1.5' - 10YR 2/1, black, wet, moderately dense, fine to medium grained, little silt, trace coarse sand 4.0 and fine gravel Breathing Zone = 0.0 ppm Silt (ML) 1.5-2.1' - 7.5YR 4/6 to 7.5YR 4/4, strong brown to no PID reading, no recovery 5 brown, moist, dense to very dense, little fine to coarse sub-angular to angular gravel, little clay 2.1-4.0' - no recovery S2 3.25 4.0 Clayey Silt (ML) 0.0 4.0-7.25' - 7.5YR 4/6, strong brown, moist, very dense to dense 7.25-8.0' - no recovery 8.0 Clayey Silt (ML) 0.5 Breathing Zone = 0.0 ppm 8.0-12.0' - 7.5YR 4/4, brown, damp to moist, very dense, trace coarse sand 10 4.0 S3 1.0 4.0 12.0 Clayey Silt (ML) 0.8 Breathing Zone = 0.0 ppm 12.0-16.0' - 7.5YR 4/3 to 4/2. brown transitioning to brown, moist to wet, dense to moderately dense (decreasing with depth), trace coarse sand and fine sub-angular to angular gravel $\frac{4.0}{4.0}$ S4 0.2 15 16.0 Clayey Silt (ML) Breathing Zone = 0.0 ppm 0.1 16.0-20.0' - 7.5YR 4/2, brown, moist, moderately soft, dense, little plasticity, trace coarse sand and fine sub-angular to angular gravel $\frac{4.0}{4.0}$ S5 0.1 20 20.0



TW-13D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :			START : 4/1/2015 END : 4/1/2		2015		LOGGER : R. Clennon			
				SOIL DESCRIPTION						
AND MO_	SAMPLE INT	ERVAL (ft)				90				
		RECOVERY	(ft)	SYMBOL, COLOR, MOISTURE CONTENT,		l⊓ ₽	(mq	COMMENTS		
EVA EVA			SAMPLER	RELATIVE DENSITY OR CONSISTENCY, SOIL		RAP	d) D			
ELSE			(TYPE)			G	Ē	Dreathing Zone - 0.0 ppm		
-	20.0			20.0-24.0 - no recovery	_		0.2	Breatning Zone = 0.0 ppm		
-					_			-		
-					_			-		
-		0.0	S6		_					
-		4.0			-			Set Temporary Well from 22.1-27.1 ft –		
-					-			bgs		
-					-			for VOC analysis -		
-	24.0			Clavey Silt (ML)				TW-13D-GW-040315 @ 1025		
-				24.0-27.1' - 7.5YR 4/2 to 7.5YR 3/2, brown to dark	-			no PID reading, no recovery –		
25				brown, moist to wet, soft, dense, low to moderate						
-		<u>4.0</u>	S7	sub-angular to sub-round gravel, crushed	-			-		
-		3.1		rock/gravel/clay in bottom 0.5' of sample (0.25' thic	:k) _		03	Driller: Hit refusal at 27.1 ft bos		
-					-		0.0			
-	27.1			Dettern of Devine at 27.1 ft below ground outfood		ĮЩ	0.0			
-				Bottom of Boring at 27.1 it below ground surface	_					
-					-			-		
-					-			-		
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BORING NUMBER: TW-13S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/2/2015 END: 4/2/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Sand and Gravel (GW) Breathing Zone = 0.0 ppm 0.0-1.4' - 10YR 4/2, dark grayish brown, wet, moderately dense, fine to coarse sand, fine to coarse sub-angular to sub-round gravel, little asphalt at surface Silt/Clay (ML/CL) 1.4-1.6' - 2.5Y 3/1, very dark gray, moist to wet, dense <u>2.9</u> 4 0 S1 0.2 Sand and Gravel 1.6-2.0' - 10YR 2/1 and 10YR 2/2, black and very dark brown, wet, moderately dense, fine to coarse sand, fine sub-angular to sub-round gravel 4.0 Silt (ML) Breathing Zone = 0.0 ppm 0.2 2.0-2.9' - 10 YR 4/2 and 4/3, dark grayish brown and brown, wet, dense to very dense, trace fine to coarse 5 sub-round gravel 2.9-4.0' - no recovery Clayey Silt (ML) S2 <u>3.8</u> 4.0 4.0-7.8' - 7.5YR 4/6 and 4/4, strong brown and brown, 0.0 moist to wet, very dense 8.0 7.8-8.0' - no recovery Breathing Zone = 0.0 ppm 0.4 Clayey Silt (ML) 8.0-12.0' - 2.5Y 4/3 and 7.5YR 4/4, brown, moist to wet, very dense 10 $\frac{4.0}{4.0}$ S3 0.4 12.0 Clayey Silt (ML) 0.2 Breathing Zone = 0.0 ppm 12.0-15.9' - 7.5YR 4/4 and 4/3 transitioning to 4/2 in 12.5-13.5', brown, wet, dense to moderately dense (decreasing with depth), little plasticity, trace fine to coarse sub-round to sub-angular gravel <u>3.9</u> 4.0 S4 0.0 15 Set Temporary Well from 15-20 ft bgs Collect sample from 15-20 ft bgs for 16.0 VOC analysis 15.9-16.0' - no recovery 0.0 TW-13S-GW-040315 @ 1015 Clayey Silt (ML) Breathing Zone = 0.0 ppm 16.0-20.0' - 7.5YR 4/2, brown, moist, moderately soft to soft, little plasticity, trace coarse gravel **S**5 <u>4.0</u> 4 0 0.1 0.0 20 20.0

Bottom of Boring at 20.0 ft below ground surface



PROJECT NUMBER: BORING

480860

BORING NUMBER: TW-14D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/1/2015 END: 4/1/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Silty Sand and Gravel (SM) Breathing Zone = 0.0 ppm 0.0-1.1' - 7.5YR 3/1 to 7.5YR 3/2, very dark gray to dark brown, wet, dense, fine to coarse sand, fine to coarse sub-round to sub-angular gravel, poorly sorted Silty Sand (SM) 1.1-1.8' - 10YR 2/1 to 2/2, black to very dark brown, <u>3.25</u> 4.0 S1 0.0 wet, dense, little fine sub-angular to sub-round gravel, few coarse sand, trace debris (brick) at 1.8' Silt (ML) 1.8-3.25' - 10YR 3/2, very dark grayish brown, damp, very dense, slight plasticity, transitioning to 7.5YR 4/2 4.0 brown at 2.5', some clay, trace coarse sand Breathing Zone = 0.0 ppm 0.0 Clayey Silt (ML) 3.25-4.0' - no recovery 5 Clayey Silt (ML) 4.0-8.0' - 7.5YR 4/4 and 4/6, brown and strong brown, moist, very dense, no to slight plasticity S2 $\frac{4.0}{4.0}$ 0.1 8.0 Clayey Silt (ML) 0.1 Breathing Zone = 0.0 ppm 8.0-11.9' - 7.5YR 4/4 and 4/6, brown and strong brown, moist, very dense, no to slight plasticity 10 <u>3.9</u> S3 1.1 4.0 12.0 11.9-12.0' - no recovery 0.7 Breathing Zone = 0.0 ppm Clayey Silt (ML) 12.0-16.0' - 7.5YR 4/2 to 10YR 4/2, brown to dark gravish brown, moist, moderately soft, dense, moderate plasticity, fine to coarse sub-round to sub-angular gravel $\frac{4.0}{4.0}$ S4 0.6 15 16.0 Clayey Silt (ML) Breathing Zone = 0.0 ppm 0.0 16.0-19.33' - 7.5YR 4/2 to 10YR 4/2, brown to dark grayish brown, moist, moderately soft, dense, moderate plasticity, fine to coarse sub-round to sub-angular gravel, increasing moisture S5 3.33 4.0 0.0 19.33-20.0' - no recovery 20 20.0



PROJECT NUMBER: BORING 480860

BORING NUMBER: TW-14D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/1/2015 END: 4/1/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clayey Silt (ML) 0.0 Breathing Zone = 0.0 ppm 20.0 20.0-21.3' - 7.5YR 4/2 to 10YR 4/2, brown to dark grayish brown, moist, soft to moderately soft, moderate plasticity, fine to coarse sub-round to sub-angular gravel, increasing moisture 21.3-24.0' - no recovery S6 <u>1.3</u> 4.0 0.2 Set Temporary Well from 22-27 ft bgs Collect sample from 22-27 ft bgs for VOC analysis TW-14D-GW-040115 @ 1145 24.0 Clayey Silt (ML) Breathing Zone = 0.0 ppm 0.4 24.0-27.0' - 7.5YR 4/3, brown, wet, moderately soft, 25 dense, moderate plasticity <u>3.0</u> 3.0 S7 0.0 Driller: Hit refusal at 27 ft bgs 27.0 Bottom of Boring at 27.0 ft below ground surface 30 35 40



480860

BORING NUMBER: TW-14S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/2/2015 END: 4/2/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Sand and Gravel Breathing Zone = 0.0 0.0-1.25' - 10YR 4/2, dark grayish brown, wet, moderately dense to dense, fine to medium sand, fine to coarse sub-angular to angular gravel, some coarse sand, some silt Silty Sand (SM) <u>3.0</u> 4 0 S1 0.0 1.25-1.85' - 10YR 2/1 and 2/2, black and very dark brown, wet, dense, little fine to coarse gravel, trace 10YR 4/4 dark yellowish brown mottling, few organics, trace debris (brick) Sandy Silt (ML/SM) 4.0 1.85-2.5' - 10YR 2/2, very dark brown, wet, Breathing Zone = 0.0 0.1 moderately dense, little 10YR 5/2 gravish brown mottling 5 Silt/Clayey Silt (ML) 2.5-3.0' - 10YR 4/3 to 4/4, brown to dark yellowish brown, moist to wet, dense to moderately dense, trace <u>3.75</u> 4.0 S2 coarse sand 0.4 3.0-4.0' - no recovery 4.0-4.3' - Slough Clayey Silt (ML) 4.3-7.75' - 10YR 4/6 to 7.5YR 4/6, dark yellowish 8.0 brown to strong brown, moist, very dense to dense, Breathing Zone = 0.0 0.1 trace coarse sand 7.75-8.0' - no recovery Clayey Silt (ML) 8.0-11.75' - 7.5YR 4/4, brown, moist, very dense to dense, trace coarse sand 10 3.75 4.0 S3 1.8 12.0 11.75-12.0' - no recovery 1.1 Breathing Zone = 0.0 Silty Clay (ML) 12.0-14.5' - 7.5YR 4/4, brown, wet, moderately soft, dense, slight to no plasticity, transitioning to 7.5YR 4/3 brown in 12-13.5', trace coarse sand, trace fine gravel <u>4.0</u> 4.0 S4 0.3 Silt (ML) 15 14.5-16.0' - 7.5YR 4/2, brown, wet, soft to moderately Set Temporary Well from 15-20 ft bgs soft, some clay, trace to little fine to very fine sand, Collect sample from 15-20 ft bgs for trace coarse sand and fine to coarse sub-angular to 16.0 VOC analysis sub-round gravel, non-plastic 0.2 TW-14S-GW-040315 @ 1105 Silt (ML) Breathing Zone = 0.0 16.0-20.0' - 7.5YR 4/2, brown, wet, soft to moderately soft, some clay, trace to little fine to very fine sand, trace coarse sand and fine to coarse sub-angular to sub-round gravel, non-plastic **S**5 <u>4.0</u> 4 0 0.2 0.2 20 20.0 Bottom of Boring at 20.0 ft below ground surface



PROJECT NUMBER: BOF

480860

BORING NUMBER: TW-15D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/2/2015 END: 4/2/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 00 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER STRUCTURE, MINERALOGY 멉 (TYPE) Silty Sand and Gravel (SM) Breathing Zone = 0.0 ppm 0.0-1.1' - 10YR 4/3, brown, wet/saturated, moderately dense, fine to medium sand, fine to coarse sub-angular to angular gravel Silty Sand (SM) 1.1-1.9' - 10YR 2/6 to 2/2, black to very dark brown, <u>2.5</u> 4.0 S1 wet, moderately dense, fine grained, little to some 1.9 gravel, trace to little organics, trace debris Silt (ML) 1.9-2.5' - 10YR 4/3 to 4/4, brown to dark yellowish brown, moist, medium stiff, very dense, trace black 4.0 (10YR 2/1) mottling, trace fine to very fine sand and 0.3 Breathing Zone = 0.0 ppm coarse sand, trace fine gravel 2.5-4.0' - no recovery 5 Clayey Silt (ML) 4.0-7.8' - 7.5YR 4/4 with 7.5YR 5/1, strong brown with trace gray mottling, moist to wet, very dense, slight S2 3.8 4 0 plasticity, trace coarse sand and fine gravel 0.5 8.0 7.8-8.0' - no recovery 0.6 Breathing Zone = 0.0 ppm 8.0-8.2' - slough Clayey Silt (ML) 8.2-11.5' - 7.5YR 4/4 with 7.5YR 5/1, strong brown with trace gray mottling, moist to wet, very dense, slight plasticity, trace coarse sand and fine gravel 10 <u>3.55</u> S3 2.2 4.0 11.5-12.0' - no recovery 12.0 Clayey Silt (ML) 2.7 Breathing Zone = 0.0 ppm 12.0-14.8' - 7.5YR 4/2, brown, moist, dense, slight to little plasticity, trace coarse sand $\frac{4.0}{4.0}$ S4 0.4 15 Clayey Silt (ML) 14.8-16.0' - 7.5YR 4/2, brown, moist, dense, slight plasticity, trace coarse sand 16.0 Clayey Silt (ML) Breathing Zone = 0.0 ppm 0.1 16.0-18.8' - 7.5YR 4/2, brown, moist to wet, dense, slight plasticity, little very fine to fine sand, trace to little fine to coarse sub-round to sub-angular gravel S5 <u>2.8</u> 4.0 0.3 18.8-20.0' - no recovery 20 20.0



BORING NUMBER: TW-15D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/2/2015 END: 4/2/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clayey Silt (ML) 0.3 Breathing Zone = 0.0 ppm 20.0 20.0-24.0' - 7.5YR 4/2, brown, moist to wet, dense, slight plasticity, little very fine to fine sand, trace to little fine to coarse sub-round to sub-angular gravel <u>4.0</u> 4.0 S6 0.0 Set Temporary Well from 22-27 ft bgs Collect sample from 22-27 ft bgs for VOC analysis TW-13D-GW-040315 @ 1045 24.0 Clayey Silt (ML) 0.0 Breathing Zone = 0.0 ppm 24.0-27.0' - 7.5YR 4/2 to 5YR 4/2, brown to dark reddish gray, wet, dense, slight plasticity, little very fine to fine sand, trace to little fine to coarse 25 1.2 <u>3.0</u> 3.0 S7 sub-round to sub-angular gravel 0.1 Driller: Hit refusal at 27 ft bgs 27.0 Bottom of Boring at 27.0 ft below ground surface 30 35 40



BORING NUMBER: TW-15S

SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/2/2015 END: 4/2/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER STRUCTURE, MINERALOGY 멉 (TYPE) Silty Sand and Gravel (SM) Breathing Zone = 0.0 ppm 0.0-1.1' - 10YR 4/3, brown, wet, moderately dense, fine to medium sand, fine to coarse sub-round to angular gravel, few to some coarse sand Silty Sand (SM) 1.1-1.5' - 10Yr 2/1 to 10YR 2/2, black to very dark <u>3.5</u> 4 0 S1 0.9 brown, wet, moderately dense, little to few fine to coarse gravel Silt (ML) 1.5-1.9' - 10YR 4/4, dark yellowish brown, moist to wet, very dense, some clay, trace coarse sand 4.0 Silt (ML) Breathing Zone = 0.0 ppm 2.1 1.9-3.0' - 10YR 4/2, dark grayish brown, moist to wet, dense to moderately dense, with little 10YR 5/6 5 yellowish brown and 10YR 2/2 very dark gray mottling, some clay Clayey Silt (ML) S2 <u>3.8</u> 4.0 3.0-3.5' - 10YR 4/4 to 7.5YR 4/4, dark yellowish brown to brown, moist to wet, dense, trace coarse sand 0.4 3.5-4.0' - no recovery 4.0-4.2' - Slough Clayey Silt (ML) 8.0 4.2-7.8' - 7.5YR 4/4 to 7.5YR 4/6, brown to strong Breathing Zone = 0.0 ppm 1.0 brown, damp to moist, very dense, trace gray (7.5YR 5/1) mottling, trace coarse sand 7.8-8.0' - no recovery Clayey Silt (ML) 10 8.0-11.5' - 7.5YR 4/4 to 7.5YR 4/6, brown to strong <u>3.5</u> 4 0 S3 brown, damp to moist, very dense, trace gray (7.5YR 2.1 5/1) mottling, trace coarse sand 11.5-12.0' - no recovery 12.0 Clayey Silt (ML) 0.8 Breathing Zone = 0.0 ppm 12.0-14.25' - 7.5YR 4/3, brown, moist, moderately soft, moderately dense, slight to little plasticity, trace coarse sand <u>4.0</u> 4.0 S4 0.8 Clayey Silt (ML) 14.25-16.0' - 7.5YR 4/3, brown, moist, moderately 15 soft, moderately dense, slight to little plasticity, Set Temporary Well from 15-20 ft bgs transitioning to 7.5YR 4/2 brown, trace coarse sand, Collect sample from 15-20 ft bgs for trace fine to coarse sub-angular to angular gravel, 16.0 VOC analysis trace very fine sand, softer with depth TW-15S-GW-070315 @ 1040 1.2 Clayey Silt (ML) Breathing Zone = 0.0 ppm 16.0-19.4' - 7.5YR 4/2, brown, moist to wet, soft, moderately dense, trace to little very fine sand, trace coarse sand and fine to coarse sub-angular to angular gravel **S**5 $\frac{3.4}{4.0}$ 1.6 19.4-20.0' - no recovery 0.9 20 20.0 Bottom of Boring at 20.0 ft below ground surface
ch2m:

PROJECT NUMBER: 480860

BORING NUMBER: TW-16D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS :				START : 4/3/2015 END : 4/3/2			LOGGER : R. Clennon
				SOIL DESCRIPTION			
EPTH BELOW JRFACE AND EVATION (ft)	SAMPLE INT	RECOVERY	(ft) SAMPLER	DEPTH INTERVAL, SOIL NAME, USCS GROU SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOI STRUCTURE, MINERALOGY		D (ppm)	COMMENTS
ELCE			(TYPE)	Sitly Sand and Gravel (SM)	<u>ס</u> וו	Ē	Breathing Zone - 0.0 ppm
	4.0	<u>3.25</u> 4.0	S1	 Sity Sand and Graver (SM) 0.0-1.2' - 10YR 4/2, dark grayish brown, wet/saturated, moderately dense to dense, fine t medium sand, fine to coarse sub-angular to sub-round gravel, some coarse sand, few organ surface, poorly sorted Sity Sand (SM) 1.2-1.9' - 10YR 2/2 to 10YR 2/1, very dark brown black, wet, dense, fine grained, little to few fine t coarse sub-angular gravel (pieces to 0.15'), trac 10YR 4/6 dark yellowish brown mottling in botton trace organics 	io ics at / n to e m 0.2',	0.4	
5	80	<u>3.75</u> 4.0	S2	Silt (ML) 1.9-2.1' - 10YR 3/3, dark brown, moist, dense, fe some clay, trace coarse sand Silt (ML) 2.1-3.25' - 10YR 4/4, brown, moist, very dense, v trace to little 10YR 4/6 dark yellowish brown mot some clay, trace medium to coarse sand 3.25-4.0' - no recovery 4.0-4.2' - slough Clayey Silt (ML) 4.2-7.75' - 7.5 YR 4/4 to 7.5YR 4/6, brown to stro	with - tiling, - - - -	0.3	Breathing Zone = 0.0 ppm
- - - 10 - -		<u>3.75</u> 4.0	S3	brown, moist, very dense, nonplastic to slight plasticity, trace medium to coarse sand and fine gravel 7.75-8.0' - no recovery 8.0-8.1' - slough Clayey Silt (ML) 8.1-11.75' - 7.5 YR 4/4 to 7.5YR 4/6, brown to st brown, moist, very dense, nonplastic to slight plasticity, trace medium to coarse sand and fine gravel	rong	0.5	Breathing Zone = 0.0 ppm
	12.0	<u>4.0</u> 4.0	S4	11.75-12.0' - no recovery Clayey Silt (ML) 12.0-12.9' - 7.5YR 4/3, brown, wet, dense to moderately dense Clayey Silt (ML) 12.9-13.25' - 7.5YR 4/3 and 10YR 5/6, brown an yellowish brown, wet, moderately dense, slight to plasticity Clayey Silt (ML) 13.25-16.0' - 7.5YR 4/3 and 4/2, brown and brow wet to saturated, soft, moderately dense, trace of sand, trace fine sand in bottom 0.25'	d o little vn, coarse	0.8	Breathing Zone = 0.0 ppm
- - - - - 20	20.0	<u>4.0</u> 4.0	S5	Clayey Silt (ML) 16.0-20.0' - 7.5YR 4/2, brown, wet/saturated, moderately soft, dense, slight plasticity, trace to fine to very fine sand, trace fine to coarse sub-ro to sub-angular gravel	little _ bund _ _ _ _ _	0.4	Breathing Zone = 0.0 ppm



PROJECT NUMBER: BORING NUMBER: 480860

TW-16D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/3/2015 END: 4/3/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 0 0 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clayey Silt (ML) 20.0-23.95' - 7.5YR 4/2, brown, wet/saturated, moderately soft, dense, slight plasticity, little to few fine to very fine sand, trace fine to coarse sub-round 0.3 Breathing Zone = 0.0 ppm 20.0 to sub-angular gravel <u>3.95</u> 4.0 S6 0.3 Set Temporary Well from 23-28 ft bgs Collect sample from 23-28 ft bgs for VOC analysis 24.0 23.95-24.0' - no recovery TW-16D-GW-040315 @ 1355 0.5 Clayey Silt (ML) 24.0-27.9' - 7.5YR 4/2, brown, wet/saturated, Breathing Zone = 0.0 ppm 25 moderately soft to moderately soft, slight plasticity, little to few fine to very fine sand, trace fine to coarse sub-round to sub-angular gravel S7 <u>3.9</u> 4 0 0.5 0.4 28.0 27.9-28.0' - no recovery Bottom of Boring at 28.0 ft below ground surface 30 35 40



PROJECT NUMBER:

480860

BORING NUMBER: TW-17D

SHEET 1 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/3/2015 END: 4/3/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 00 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY 멉 Silty Sand and Gravel (SM) Breathing Zone = 0 0.0-0.8' - 10YR 4/2, dark grayish brown, wet/saturated, moderately dense, fine to medium sand, fine to coarse sub-angular to sub-round gravel, few to some coarse sand Silty Sand (SM) <u>2.25</u> 4.0 S1 0.0 0.8-1.1' - 10YR 2/1 to 2/2, black to very dark brown, wet to moist, moderately dense, trace fine to coarse sub-angular to angular gravel Silt (ML) 1.1-2.25' - 10YR 4/2 amd 4/3, dark grayish brown and 4.0 brown, wet/saturated, fine to medium sand, fine to Breathing Zone = 0 0.6 coarse sub-angular to angular gravel 2.25-4.0' - no recovery 5 4.0-4.25' - slough Silt (ML) 4.25-4.75' - 7.5YR 4/4 and 4/6, brown and strong S2 0.75 4.0 brown, wet, dense, trace coarse sand and fine 0.0 sub-angular to angular gravel 4.75-8.0' - no recovery 8.0 Clayey Silt (ML) 0.3 Breathing Zone = 0 8.0-12.0' - 7.5YR 4/4, brown, moist to wet, very dense, trace coarse sand, trace fine gravel 10 4.0 S3 0.5 4.0 12.0 Clayey Silt (ML) 0.2 Breathing Zone = 0 12.0-15.0' - 7.5YR 4/4. brown. moist to wet. verv dense to moderately dense, transitioning to 7.5YR 4/2 brown in 12.5-13.5 ft, trace 7.5YR 4/6 strong brown and 10YR 4/6 dark yellowish brown mottling, trace coarse sand and gravel, decreasing density with $\frac{4.0}{4.0}$ S4 depth 0.4 15 Clayey Silt (ML) 15.0-16.0' - 7.5YR 4/2 and 10YR 4/2, brown and dark grayish brown, soft, moderately dense, trace to slight 16.0 plasticity, trace coarse sand Breathing Zone = 0 0.3 Clayey Silt (ML) 16.0-18.75' - 10YR 4/2 and 7.5YR 4/2, dark grayish brown and brown, wet, soft to moderately soft, trace to little very fine to fine sand, trace coarse sand and fine to coarse sub-angular to sub-round gravel, non-plastic S5 <u>2.75</u> 0.3 40 18.75-20.0' - no recovery 20 20.0



PROJECT NUMBER: 480860

BORING NUMBER: TW-17D

SHEET 2 OF 2

SOIL BORING LOG

PROJECT : Dowell Depew

LOCATION : Depew, New York

ELEVATION : Not Measured

DRILLING CONTRACTOR : Parratt Wolf Inc.

DRILLING METHOD AND EQUIPMENT : DPT-Geoprobe 2278 DT #242

WATER LEVELS : ---START : 4/3/2015 END: 4/3/2015 LOGGER : R. Clennon SOIL DESCRIPTION DEPTH BELOW SURFACE AND ELEVATION (ft) 9 0 SAMPLE INTERVAL (ft) DEPTH INTERVAL, SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL RECOVERY (ft) GRAPHIC (mdd) COMMENTS SAMPLER (TYPE) STRUCTURE, MINERALOGY Ē Clayey Silt (ML) 0.3 Breathing Zone = 0 20.0 20.0-23.1' - 7.5YR 4/2, brown, wet, moderately soft, dense, little to few fine to very fine sand, trace coarse sand and fine to coarse sub-round to sub-angular gravel S6 <u>3.1</u> 4.0 0.1 Set Temporary Well from 22.5-27.5 ft bgs Collect sample from 22.5-27.5 ft bgs 23.1-24.0' - no recovery for VOC analysis 24.0 TW-17D-GW-040315 @ 1445 Clayey Silt (ML) 0.3 Breathing Zone = 0 24.0-27.5' - 7.5YR 4/2, brown, wet, moderately soft, dense, little to few fine to very fine sand, trace coarse 25 sand and fine to coarse sub-round to sub-angular gravel, sand content increasing with depth S7 <u>3.5</u> 3.5 0.2 27.5 Bottom of Boring at 27.5 ft below ground surface 30 35 40

Attachment 3

Geotechnical Laboratory Data Reports

Attachment 4

Analytical Laboratory Data Reports

Appendix B Health and Safety Plan

Health and Safety Plan

Former Dowell Schlumberger Depew Facility (Depew, NY)

> Prepared for Schlumberger Technology Corporation The Dow Chemical Company

> > July 2015 (Revision 3)

ch2m:

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Emergency Contacts

24-hour CH2M HILL Injury Reporting– 1-866-893-2514 24-hour CH2M HILL Serious Incident Reporting Contact – 720-286-4911

Serious Incident Reporting:	Injury Management/Return-to-Work
720-286-4911	(IMRTW - For US and Puerto Rico employees only)
	1-866-893-2514
Medical Emergency – 911	CH2M HILL IMRTW Medical Consultant
C ,	WorkCare
	Peter P. Greaney, MD
	300 S. Harbor Boulevard, Suite 600
	Anaheim, CA 92805
	1-714-456-2114; 1-800455-6155
	(After hours call 1-866-893-2514 for response by on-call physician)
Fire/Spill Emergency – 911	Local Occupational Physician (Insert)
Security & Police – 911	CH2M HILL Responsible Health and Safety Manager
	(RHSM)
	Name: Eric Hamm
	Phone: cell 626-644-2563
Utilities Emergency Phone Numbers	CH2IVI HILL Project Environmental Manager
Waler: 911	Name: Linua Colella Phone: (720) 286 5114: cell (720) 220 2500
GdS. 911 Electric: 011	Phone. (720) 280-3114, cell (720) 320-2390
CH2M HILL Project Manager	CH2M HILL Worker's Compensation:
Name: Jayson Burkard	Contact Market HR dept. to have form completed or
Phone: (314) 335-3046; cell (314) 477-7284	contact Julie Zimmerman's (DEN/720-286-2375)
CH2M HILL Safety Coordinator (SC)	Media Inquiries Corporate Strategic Communications
Name: Jayson Burkard	Name: John Corsi
Phone: (314) 335-3046; cell (314) 477-7284	Phone: 720.286.2087
Automobile Accidents: In the event of a car accident,	Worker's Compensation:
field staff should first treat any medical issues (9-1-1 if	Complete HITS to initiate process. For immediate
emergency), then contact the Project Manager and	assistance contact assistance contact Vicki Finke/ANV at
RHSM. Refer to Vehicle Accident Guidance document	907-762-1554 or for an after-hours emergency contact
included in the Attachment 6.	Mary Ellegood-Oberts/DEN (720-286-2291)
Rental: Mary Ellegood-Oberts/DEN (720-286-2291)	
CH2M HILL owned or fleet vehicle: Linda George/DEN	
720-286-2057	
Federal Express Dangerous Goods Shipping	CHEMITEL (hazardous material spills)
Phone: 800/238-5355	Phone: 800/255-3924
CH2M HILL Emergency Number for Shipping Dangerous	
Goods	
Phone: 800/255-3924	
Contact the Project Manager. Generally, the Project Mana	ager will contact relevant government agencies.
Facility Alarms: To be determined daily based on work	Evacuation Assembly Area(s): TBD daily based on work
locations	locations

Facility/Site Evacuation Route(s): To be determined daily based on work locations

Directions and MAP to Local Hospital

Local Hospital: Sisters of Charity Hospital, St. Joseph Campus 2605 Harlem Road Cheektowaga, NY 14225 (716) 891-2400



Driving directions to Sisters of Charity Hospital, St. Joseph Campus

8

B

3311 Walden Ave Depew, NY 14043

1. Head west on Walden Ave toward Brewster St

4.7 mi

2. Turn right onto Harlem Rd Destination will be on the right

0.5 mi

Sisters of Charity Hospital, St. Joseph Campus 2605 Harlem Rd Cheektowaga, NY 14225

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Attachment 2	Chemical Inventory/Register Form
Attachment 3	Chemical-Specific Training Form
Attachment 4	Project Activity Self-Assessment Checklists/Forms/Permits
Attachment 5	Key Target Zero Program Elements Forms
Attachment 6	Fact Sheets
Attachment 7	Observed Hazard Form
Attachment 8	Stop Work Order Form
Attachment 9	Agency Inspection Target Zero Bulletin
Attachment 10	Completed CH2M HILL AHAs
Attachment 11	Material Safety Data Sheets

Approval

This Health and Safety Plan (HSP) has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific project and site conditions and identified scope(s) of work and must be amended if those conditions or scope(s) of work change.

By approving this HSP, the Responsible Health and Safety Manager (RHSM) certifies that the personal protective equipment has been selected based on the project-specific hazard assessment.

Original Plan

RHSM Approval Date: Mark Orman

Mail Onnon

Date: June 2, 2014

Date: June 3, 2014

Project Manager Approval:

Jayson Burkard

Gi Dame

uchaved

Revisions 1

Revisions Made By: Eric Hamm

Date: October 27, 2014

Date: October 27, 2014

Description of Revisions to Plan: Revisions have been made to the following Sections – TOC; 3.0; 4.0; 7.0; 9.0; 15.0; Footers

Revisions Approved By:

Revision 2

Revision Made By: Eric Hamm

Date: January 5, 2015

Description of Revision: The HSP has been replaced with the current CH version of the HSP and HSSE Manual and revised according to new scope items.

Revision Approved By:

Gij Dame

Date: January 5, 2015

Revision 3

Revision Made By: Eric Hamm

Date: July 14, 2015

Description of Revision: Revised for new Tasks; updated the following Sections – Cover; TOC; Emergency Contacts; 2.0; 3.0; 5.0; 6.0; 8.0; 9.0; 10.0; 11.0; 14.0; 19.0 and Attachments 4 and 6

Revision Approved By:

Date: July 14, 2015

Revision 4

Revision Made By:

Description of Revision:

Revision Approved By:

Date:

Date:

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1. Applicability

This HSP applies to:

- All CH2M HILL staff, including subcontractors and tiered subcontractors of CH2M HILL working on the site
- All visitors to CH2M HILL construction or remediation sites in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company).

In addition, Subcontractors and tiered subcontractors shall also follow any of their company HSE programs, and site-specific HSPs and AHAs.

This HSP does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL.

This HSP defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This HSP will be kept onsite during field activities and will be reviewed as necessary. The HSP will be revised as project activities or conditions change or when supplemental information becomes available. The HSP adopts, by reference, the CH2M HILL Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, applicable requirements contained in the Environment and Nuclear (E&N) Market (E&NM) Health, Safety, Security, and Environment (HSSE) Handbook (Handbook) will be implemented. The Handbook is available as a stand-alone Handbook at the project site. The HSP may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this HSP and any governing regulation, the more stringent and protective requirement shall apply.

All CH2M HILL staff and subcontractors must sign the employee sign-off form (Attached to this HSP) to acknowledge review of this document. Copies of the signature page will be maintained onsite by the Safety Coordinator (SC).

2.1 Project Information and Background

Project Number: 480860	Project/Site Name: F Former Dowell Schlumberger – Depew, NY
Client: Schlumberger Technology Corporation and The Dow Chemical Company	Site Address: 3311 Walden Ave., Depew, NY 14043
CH2M HILL Project Manager: Jayson Burkard	CH2M HILL Office: STL
DATE HSP Prepared: Revision 3 – July 14, 2015	Date(s) of Site Work: July 2015 – June 2016

2.2 Site Location and Background

The site is located east of Buffalo, New York, at 3311 Walden Avenue in the Village of Depew (Figure 1). The site is located in a mixed residential and industrial/commercial area. Properties surrounding the site include Walden Avenue to the north, a CSX railroad yard to the south, a lumber yard and supply store (84 Lumber) to the east, and a mattress manufacturer (Buffalo Batt and Felt) to the west (Figure 2). A residential neighborhood and a recycling facility (EnviroSense Corp.) are located adjacent to the site on the north side of Walden Avenue.

The site covers approximately 1.8 acres and is relatively flat with a gentle downward slope to the north–northwest toward Walden Avenue. Maximum relief across the site (that is, from south to north) is about 4 feet, and surface water flows from south to north across the site. The property is currently vacant (site buildings were razed in 2003 and 2004), and the ground surface consists primarily of gravel and grass with small- to medium-sized trees on portions of the site. With the exception of monitoring wells, there are no structures present onsite. A 6-foot-high chain-linked fence with a locked entrance gate along Walden Avenue surrounds the site.

The chemicals of concern (COCs) are volatile organic compounds (VOCs) primarily 1,1-Dichloroethane (1,1 DCA), 1,1-Dichloroethane (1,1-DCE), 1,2-DCA, 1,1,1-Trichloroethane (1,1,1-TCA), Chloroethane, and Vinyl Chloride (VC). Figure 3 presents the locations of the VOC detections and the concentrations.

2.3 Description of Tasks

Future tasks to be completed at the Former Dowell Schlumberger Depew, New York site will include the following:

- Daily mobilization/demobilization
- Plug and abandon exiting monitoring wells
- Drill and install new monitoring wells and collect soil samples
- Groundwater sampling
- Establish temporary facilities for operation of ISTT System, e.g., office trailer, portable sanitary facilities, decontamination area, storage trailer(s), and construction material and chemical staging area(s)
- Provide electrical power to the site to run ISTT System
- Installation of ISTT systems including ERH or heating wells, vapor recovery wells, extracted vapors and fluids conveyance piping and a vapor recovery and treatment system.
- O&M of ISTT System
- Air permitting
- Utility locating
- IDW Management
- Packing and shipping samples to the laboratory

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non- HAZWOPER -trained personnel. **Prior approval from the Responsible Health and Safety Manager (RHSM) is required before these tasks are conducted on regulated hazardous waste sites.**

CH2M HILL and Subcontractor employees engaging in hazardous waste operations (HAZWOPER) or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65 (or if required by Subcontract). Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities. See the following tasks that are managed under HAZWOPER requirements.

2.4 Change Management

Changes to this HSP shall be documented and approved by the CH2M HILL Responsible Health and Safety Manager for the project. The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this HSP.

2.5 Changes to Health and Safety Plans

Changes to the HSP shall be documented and accepted by using the Health and Safety Field Change Request (FCR) form (included in Attachments) or by resubmitting a revised HSP for acceptance. A revised HSP should be produced when a large number of changes (e.g., 15 or more not including AHAs) using FCRs has been employed. The CH2M HILL Project Manager (PM) and RHSM shall be responsible for the review and acceptance of the FCR, and the RHSM will maintain an FCR log of approved changes. Field Change Requests are not required for safety-related changes that a Safety Coordinator (SC) or RHSM would normally make in the field, such as upgrade or downgrade to PPE within pre-established action levels, expansion or reduction of work control zones based on air monitoring results, and similar changes made within the operating parameters of the HSP. The field copy of the HSP shall be kept up to date by annotating the appropriate section (i.e., update to AHA) to indicate that an FCR is in effect; copies of FCRs should be kept with the HSP. The FCR number must be referenced in the HSP and available for review.

2.6 Daily Safety Meetings and Pre-Task Safety Plans

Safety meetings are to be held with all project personnel in attendance to review the hazards, controls, and required procedures/AHAs that apply for each day's activities, as well as any environmental issues, requirements and/or best management practices:

- Everyone involved in the day's work needs to sign a sign-in form to show they've had a briefing/attended a meeting.
- Pre-Task Safety Plans (PTSPs) serve the same purpose as general safety meetings, but the PTSPs are completed by individual crews to focus on those hazards posed by their specific work.
- For smaller crews, or if there is just one activity, the PTSP is often used as a means to document the overall Safety Meeting.

A copy of the PTSP and Daily Safety Meeting sign-in sheet is included as an Attachment.

2.7 Subcontractor HSSE Chartering Meeting

A subcontractor HSSE chartering meeting shall be held with subcontractors performing field work on the project. The purpose of the meeting is to discuss and agree on key HSSE requirements on a project, and to emphasize and reinforce CH2M HILL expectations for subcontractor HSSE performance. The target audience includes key CH2M HILL project staff with HSSE responsibilities (e.g., PM, RHSM, SC, Field Team Leader (FTL)) and key Subcontractor staff (e.g., project manager, supervisors, designated field HSSE contact, drill team leads, foreman). For small scale projects (e.g., small drill crew and limited CH2M HILL staff), all the subcontractor crew members should attend if available. The meeting should be held prior to mobilization with enough time to ensure that HSSE issues identified can be addressed prior to the start of work. The meeting can be held over the phone or in person depending on project needs. An example agenda can be found in the E&NM <u>Program Element Guideline,</u> <u>"Subcontractor HSSE Chartering Meeting."</u>

Site Figures FIGURE 1 – DEPEW, NY SITE LOCATION



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FIGURE 2 – DEPEW, NY SITE MAPS



FIGURE 3 – DEPEW, NY VOC EXCEEDANCES



FIGURE 4 – DEPEW, NY VOC LEVELS

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FIGURE 5 – DEPEW, 3D CONCEPTUAL DESIGN OF ISTT SYSTEM

3. Project Organization and Responsibilities

A full description of responsibilities, including Employee Responsibilities and Authority, can be found in the Handbook, Section 3, "Roles and Responsibilities."

3.1 Client

Contact Name:	Vic Cocianni, Schlumberger Remediation Leader
Phone:	(281) 285-4747
Contact Name:	Jim Strunk, Dow Remediation Leader
Phone:	215.785.7373

3.2 CH2M HILL

Г

Project Manager:		
PM Name:	Jayson Burkard	
Office:	STL	
Telephone number:	(314) 335-3046	
Cellular Number:	(314) 477-7284	

Environmental Manager:		
EM Name:	Linda Colella	
Office:	DEN	
Telephone number:	(720) 286-5114	
Cellular Number:	(720) 320-2590	

Responsible Health and Safety Manager:						
RHSM Name:	Eric Hamm					
Office:	SCO					
Telephone number:						
Cellular Number:	Cellular Number: Cell 626-644-2563					

Safety Coordinator:			
SC Name:	Jayson Burkard		
Office:	STL		
Telephone	(314) 335-3046		
Cellular Number:	(314) 477-7284		

3.3 CH2M HILL Subcontractors

Subcontractor: Blood Hound (utility locate)						
Contact Name:	TBD					
Telephone number:						
Cellular Number:						

Subcontractor: Driller (TBD)					
Contact Name:	ТВD				
Telephone					
Cellular Number:					

Subcontractor: ISTT Thermal System Installation and O&M						
Contact Name:	TBD					
Telephone number:						
Cellular Number:						

Subcontractor:					
Contact Name:	TBD				
Telephone					
Cellular Number:					

3.4 Client Contractors

	Client Contractor:
Contact Name:	NA
Telephone number:	

Client Contractor:						
Client Name:	NA					
Telephone						

Cellular Number:

This HSP does not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the client contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues).

4. Standards of Conduct

All individuals associated with this project must work injury-free and drug-free and must comply with the standards of conduct stated in the Handbook (Section 4, "Standards of Conduct"), comply with all requirements of this HSP, and Subcontractors must also comply with the safety requirements of the Subcontractor HSP. Forms related to Subcontractor Safety (i.e., Observation Hazard Form and Stop Work Order Form) are attached to this HSP.

5. Project Hazard Analysis

A health and safety risk analysis (Table 5-1) has been completed for this project. Specific project activities are listed in Table 1 with a designation the hazard and associated activity. An Activity Hazard Analysis needs to be developed for each project activity. AHAs prepared for CH2M HILL activities are included as an attachment to this HSP. The HSSE Handbook included in the Attachment 1, must be utilized to reference information for the topics covered in Table 5-1.

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL prior to the start of work. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project-specific safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

				-								
Associated Hazard Section	Daily Mobilization/ Demobilization	Plug and abandon exiting monitoring wells	Drill and install new monitoring wells and collect soil samples	Groundwater sampling	Establish temporary facilities for operation of ISTT System	Provide electrical power to the site to run ISTT System	Installation of ISTT systems	O&M of ISTT System	Air permitting	Utility locating	IDW Management	Packing and shipping sample to laboratory
General Hazards	– Refer t	to Gene	ral Haza	nrds a	nd Cont	rols in	HSSE H	landbo	ok, Sec	tion 7.		
Blood Borne Pathogens	x	х	х	х	х	Х	Х	х		х	х	х
Chemical Storage		х	х	х							х	
Drilling		х	х				Х			Х		
Driving Safety	Х											

TABLE 5-1 GENERAL ACTIVITY HAZARD ANALYSIS

Project Activity Section	Daily Mobilization/ Demobilization	Plug and abandon exiting monitoring wells	Drill and install new monitoring wells and collect soil samples	Groundwater sampling	Establish temporary facilities for operation of ISTT System	Provide electrical power to the site to run ISTT System	Installation of ISTT systems	O&M of ISTT System	Air permitting	Utility locating	IDW Management	Packing and shipping sample to laboratory
Electrical Safety						Х	Х	х				
Extended Work Hours and Fatigue Management	x	х	х	х	х	х	х	х	х	х	х	х
Field Ergonomics and Manual Lifting	x	х	х	х	х	х	х	х	х	х	х	х
Field Vehicles	х	Х	х	х	х	Х	Х	х		Х	Х	Х
Fire Prevention	х	Х	х	х	х	х	Х	х		Х	Х	Х
General Practices and Housekeeping	x	х	х	х	х	х	х	х	х	х	х	х
Hazard Communication		х	х								Х	Х
Knife Use		х	х			х	Х	х				
Lighting		Х	х	х	х	Х	Х	х	Х	Х	Х	Х
Personal Hygiene	х	Х	х	х	х	х	Х	х	Х	Х	Х	Х
Personal Security	х	Х	х	х	х	Х	Х	х	Х	Х	Х	Х
Shipping and Transportation of Hazardous Waste											Х	х
Substance Abuse	х	Х	Х	х	х	х	Х	х	х	Х	Х	Х
Project-Specific Hazards – Ro	efer to H	ISSE Ha th	ndbook is plan	, Sect when	ion 8, a specifie	nd the	additio	onal pro	oject-sp	ecific	control	ls in
Chlorinated Hydrocarbons		X`	X	x	X	X	Х	х		х	Х	х
Benzene		х	х	х	х	х	Х	х		Х	Х	Х
Drum and Portable Tank Handling		Х	х	х	х		х	х			х	
Drum Sampling Safety											Х	
Earthmoving Equipment						х						
Energized Electrical Work						Х	Х	х				
Forklift Operations		Х	x		x	Х	Х				Х	
Groundwater Sampling/Water Level Measurements				x								
Hand & Power Tools		Х	х	Х	х	Х	Х	х		Х	Х	Х

Associated Hazard Section	Daily Mobilization/ Demobilization	Plug and abandon exiting monitoring wells	Drill and install new monitoring wells and collect soil samples	Groundwater sampling	Establish temporary facilities for operation of ISTT System	Provide electrical power to the site to run ISTT System	Installation of ISTT systems	O&M of ISTT System	Air permitting	Utility locating	IDW Management	Packing and shipping sample to laboratory
Lockout/Tagout Operations					х	х	Х	х				
Portable Generator Hazards		х	х									
Pressure Washing Operations			х									
Slips, Trips and Falls		х	х	х	х	х	Х	х		Х	х	х
Stairways and Ladders			х		х	х	Х	х				
Traffic Safety		х	х	Х	х	Х	Х	х		Х	Х	
Utilities (Underground)		х	х		х		Х			Х		
Utilities (Overhead)		х	х		х		Х			Х		
Vacuum Trucks								х				
Working Alone	х			Х				х		Х	Х	Х
Physical Hazards – Refer to P	hysical	Hazards controls	in HSSI s in this	E Han plan	dbook, s when sr	Sectior Decified	n 9, and 1.	d the ad	ditiona	al proje	ect-spe	cific
Noise		х	х	· · · ·								
Ultraviolet Light exposure (sunburn)	х	Х	Х	х	х	х	х	х	х	х	х	х
Temperature Extremes	х	Х	Х	Х	х	Х	Х	х	Х	Х	Х	Х
Biological Hazards – Refer to	o Biolog	gical Ha	zards in trols in	HSSE this n	Handbo	ook, Se	ction 1	LO, and	the add	ditiona	l proje	ct-
Bees and Other Stinging Insects	sper	X	X	X			X	х	х	х	х	х
Feral Dogs		Х	х	х	х	Х	Х	х	х	Х	Х	х
Fire Ants		х	х	х	х	х	Х	х	х	Х	х	х
Mosquito Bites		х	х	х	х	Х	Х	х	Х	Х	Х	х
Poison Ivy, Oak and Sumac		х	х	х	х	Х	Х	х	х	х	Х	х
Snakes		Х	х	х	х	Х	Х	х	х	х	Х	х
Spiders – Brown Recluse and Black Widow		х	х	х	х	х	х	х	x	х	х	x
Ticks		Х	х	х	х	Х	Х	х	Х	Х	Х	х

6. Hazards and Controls

Safe work practices and hazard control measures to reduce or eliminate potential hazards as identified in Table 1 are stated in the Handbook, Sections 7-10, the associated CH2M HILL SOP, and are addressed in project AHAs. Any additional project-specific control measures, or those hazards requiring additional emphasis, are identified in the following sections.

Always consult the appropriate CH2M HILL Enterprise SOP to ensure all requirements are implemented. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

6.1 General Hazards and Controls

6.1.1 Chlorinated Hydrocarbons

An organochloride, organochlorine, chlorocarbon, chlorinated hydrocarbon, chloroalkane, or chlorinated solvent is an organic compound containing at least one covalently bonded atom of chlorine. Their wide structural variety and divergent chemical properties lead to a broad range of names and applications. Many derivatives are controversial because of the effects of these compounds on the environment and on human and animal health.

- Most of these compounds have an anesthetic or narcotic effect, causing people to feel intoxicated if overexposed. This can be particularly dangerous when working around machinery, as judgment and coordination can be impaired.
- Some of the chlorinated solvents are strong systemic poisons which damage the liver, kidneys, nervous system, and other organ system. These symptoms most often appear gradually, with nausea, loss of appetite, vomiting, headaches, weakness, and mental confusion most common.
- All chlorinated solvents can cause dermatitis (chapping, drying, rashes) on repeated contact with the skin, since they remove the protective fats and oils.
- Many of the compounds are highly irritating to the membranes around the eyes, and in the nose, throat, and lungs. Examples of chlorinated solvents which have irritating properties are ethylene dichloride and chloroform.
- In studies on laboratory animals, many chlorinated hydrocarbons have been linked to the development of cancer in animals; examples of these compounds are: ethylene dichloride, perchloroethylene, chloroform and methylene chloride, etc.
- When excessively heated, chlorinated solvents can decompose, forming highly toxic fumes such as phosgene, hydrochloric acid and chlorine.
- Most of the chlorinated hydrocarbons are non-flammable.

If air monitoring indicates that there is potential exposure at the action level concentrations indicated in Table 12-1, notify the RHSM to ensure engineering, administrative and/or PPE requirements have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.

6.1.2 Fatigue and Journey Management

Managing fatigue and the journey to remote locations is of concern. When travel takes longer than expected due to conditions that require slow speeds, it can make a long day longer. CH2M HILL has prepared a Journey Management Process, attached to this HSP, to mitigate hazards associated with travel.

In addition, workers need to consciously assess themselves as to their personal "fitness for duty" for completing field work during the day. Terrain during this field effort can be demanding and may take much focus and effort. A short checklist is included as an attachment to the HSP that asks simple questions to engage the worker and to help them decide when to keep working and when not to and should be completed twice a day—once before field work, and once after lunch.

As a rule of thumb, field work shall not be scheduled for more than 10 hours a day and workers shall not be conducting field work before dawn or after dusk. Make sure you leave plenty of time when on foot or on UTV to get back to the field vehicle before it gets dark. Work days should not exceed 12 hours per day when commute time is added in. If work hours are exceeding these times, contact the PM and RHSM. Additional fatigue management measures may be required.

See also the Extended Work Hours and Fatigue Management section of the E&N Market HSSE Handbook for fatigue information.

Definition of Fatigue

Fatigue is defined as a state of being tired. It can be caused by long hours of work, long hours of physical or mental activity, inadequate rest, excessive stress, or combinations of these factors. The signs, symptoms, and affect fatigue has on workers varies from one person to the next, however fatigue may affect the individual worker's ability to perform mental and physical tasks, including driving and working with tool and equipment. The resultant fatigue can lead to any of the following hazardous conditions, effects, or behaviors:

- Inability to see properly;
- Slower reflexes and reactions;
- Micro sleeps (up to 60 seconds where the brain goes to sleep and worker blacks out no matter what they are doing);
- Automatic behavior (where worker does routine tasks but is not having any conscious thoughts);
- Inability to make good decisions or plans;
- Inability to solve problems;
- Inability to concentrate, including wandering thoughts;
- Decreased alertness and watchfulness;
- Inability to remember things just done, seen, or heard;
- Inability to notice things the worker usually would notice;
- More mistakes than usual;
- Failure to respond to changes in surroundings or situation;
- Poor logic and judgment, including taking risks the worker usually would not take;
- Inability to respond quickly or correctly to changes;
- Inability to communicate well;
- Inability to handle stress;
- Moodiness (example -irritable, restlessness, depression, giddiness, grouchiness, and impatience).

All CH2M Hill workers, supervisors, and management by way of this HSP, will be trained to recognize and respond to fatigue issues at the workplace. It is the responsibility of the supervisor to make corresponding changes to work requirements if fatigue impairment signs are evident. All concerns should be communicated to management and corresponding changes should be documented for review and follow-up.

Responsibilities of Management

- To ensure fatigue management is implemented throughout the project;
- Ensure crews are strategically positioned for work the following day;
- Communicate expectations to the workers;
- Monitor the effects of extended work hours;
- Monitor expected weather conditions for suitability of travel;
- Support workers who are experiencing concerns with fatigue;
- Investigate any problems and/or concerns;
- Review the HSP.

Responsibilities of Supervisors

- Scheduling of work and rest days;
- Ensure all crewmembers understand signs and symptoms of fatigue;
- Conduct safety meetings discussing fatigue management;
- Solicit short-term help to minimize the need for extended hours;
- Ensure tasks are performed in safe and healthy manner;
- Be aware of the possible risks associated with extended hours and/or consecutive days of work;
- Give workers as much notice as possible if extended hours are anticipated;
- Account for workers returning from sickness, absences and/or modified work;
- In conjunction with workers, identify health problems which may affect a workers ability to work extended hours i.e. diabetes;
- Consider travel time to and from work;
- Observe and record how individuals respond to extended hours;
- Recognize individual and crew fatigue;
- Get feedback from individual crewmembers and the crew as a whole;
- Assess and control hazards and risks and take prompt action if a risk develops;
- Relay information to and from management & workers;
- Report any FMP problems, concerns and/or issues.

Responsibilities of Workers

- Actively participate in fatigue management training by way of this HSP;
- Take short and frequent breaks;
- Recognize symptoms of fatigue;
- Promptly report any fatigue related concerns;
- Report any individual medical or personal situations, which may have an effect on fatigue;
- To get proper rest during time off;
- Identify personal stress and seek assistance if required.
- Rotate and perform various functions of short duration during extended hours;
- Perform complex tasks earlier in the shift, if possible.

6.1.3 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Lightning

Lightning can strike more than 10 miles away from the center of a thunderstorm - well beyond the audible range of thunder. Therefore, if you hear thunder, you're already within striking range of a storm and should seek shelter immediately, especially if in an open area.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop—seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Avoid close contact with others. Spread out at least 50 feet apart in order to minimize the chance of everyone in a group being struck.
- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- With no other options, use the field vehicle or take shelter under a group of shorter trees among larger trees. A thick forest is far better than a lone tree or a small group of trees. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The typical lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap. This may not give you enough time to find an optimal shelter, given the location. When you hear thunder, look for shelter.

Flash Flooding

Flash flooding is a result of heavy localized rainfall such as that from slow moving intense thunderstorms. Flash floods often result from small creeks and streams overflowing during heavy rainfall. These floods often become raging torrents of water which rip through river beds, city streets, and valleys or canyons, sweeping everything with them. Flash Flooding usually occurs within 6 hours of a heavy rain event.

- In hilly or mountainous terrain, flash floods can strike with little or no advance warning. Distant rain may be channeled into gullies and ravines, turning a quiet stream into a rampaging torrent in minutes. Never set up base camp or park on low ground next to streams.
- Do not cross flowing stream on foot where water is above your ankles.
- If you are driving, don't try to cross water-filled areas of unknown depths. If your vehicle stalls, abandon it immediately and go to higher ground. Rapidly rising water may sweep the vehicle and its occupants away. Many deaths have been caused by attempts to move stalled vehicles.
- Don't try to outrace a flood on foot. If you see or hear it coming, move to higher ground immediately.
- Be familiar with the land features and watch for drainage ditches or small streams.
- Stay tuned to weather forecasts and NOAA Weather Radio for the latest statements, watches and warnings concerning heavy rain and flash flooding in your area. The National Weather Service will issue a Flash Flood

Watch when heavy rains may result in flash flooding in a specific area. In this case you should be alert and prepare for the possibility of a flood emergency which will require immediate action. A Flash Flood Warning will be issued when flash flooding is occurring or is imminent in a specified area. If your locale is placed under a warning, you should move to safe ground immediately.

Windy Conditions

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly. If wind kicks up potentially impacted soils at claim sites, suspend work and move upwind. Do not commence work unless wind is not causing dust to be airborne.

Winter Weather

Work will not commence if winter weather is forecasted. Contact the PM.

6.1.4 Mower, Brush Hog and Weed Trimmer Safety

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are working near or using mowers, brush hogs and weed trimmers. Ensure that the following requirements are followed:

Operation: Safely monitor construction site during site clearing operations when the Brush Hog is being operated. Please follow all H&S procedures listed below.

Procedure:

- Meet with the brush hog or mower crew during the safety tailboard and immediately prior to operations to ensure all personnel understand the signal that indicates when the operator will operate the brush hog.
- Sweep the area where the brush hog or mower is scheduled to cut the vegetation.
- Move into a safe area following Health and Safety requirements described below.

The procedures described above provide a safe method to monitor a site undergoing site clearing operations when the brush hog is in operation. The brush hog is a dangerous machine that will throw rocks and debris long distances at speeds that can and have caused significant injury. Maintain a safe distance from all site clearing equipment.

CH2MHILL requires that all monitors incorporate the following safety precautions during brush clearing operations:

- Conduct a sweep of the area where the brush hog or mower is scheduled to cut vegetation and 100 foot buffer prior to mower, brush hog, masticator and trimmer operations and then leave the area. Monitors or their vehicles must never be within 300 feet of the brush clearing operation.
- Restrict monitoring activities to 300' outside the staked limits of the work area while brush clearing equipment is operating.
- Monitors should position themselves 180 degrees towards the rear of the mower, always maintaining >300' from the edge the area being cleared by the mower.
- Increased focus during daily safety tailboard meetings on equipment operations and safe distances
- Minimum PPE Requirements leather boots with safety toes, safety glasses, leather gloves, hard hat, long pants, and high visibility vest.

General Safety Precautions for mowers/brush hogs:

• The equipment operator must read the owner's manual prior to operating the equipment.

- Make all necessary adjustment prior to turning on the equipment.
- Practice operation in an open area.
- Make sure all protective guards are in place. Never remove guards.
- Determine that steering is responsive before beginning a job.
- Test the brakes.
- Clean the steps and operating platform to prevent slipping.
- Ensure that tires are properly inflated.
- Wear proper PPE, e.g., hearing protection, hard hat, safety glasses, leather boots with protective toes, leather gloves and long pants.
- Only the operator should be riding on the equipment, no passengers are allowed.
- When leaving the seat, the operator should disengage the Power Take Off (PTO), engage the brake, stop the engine, and wait for all parts to stop before dismounting.
- The operator should not adjust any mechanism of the equipment while the mower is running, making sure all parts have stopped moving prior to making any adjustments.
- When driving between mowing jobs, crossing a road, path or sidewalk, or when not using the mower, the operator should disengage the PTO to stop the mower blade.
- Operators should not mow in conditions where traction or stability is questionable. If uncertain, test drive a section with the PTO off.
- Never refuel equipment while the engine is running or extremely hot. A fire or explosion could result.
- When mowing on uneven ground follow these rules:
 - Reduce the travel speed so that you can see and react to hazards in your path. Overturns are four times more likely to occur when the speed is doubled.
 - Be on the alert for holes and ditches covered by grass or debris. A wheel may drop and cause an overturn.
 - Drive up and down a hill, not across.
 - Do not stop when going up hill or down hill. If the mower stops going up hill, turn off the PTO and back down slowly.
 - Do not try to stabilize the mower by putting your foot on the ground.

Project Specific Safety Precautions for Mowers and Brush Hogs:

Mowers or brush hogs are capable of propelling objects greater than 200' or becoming entangled in rope, wire or other objects that can endanger workers in the vicinity. Prior to beginning mowing operations the area must be canvassed for loose debris, rocks, logs, foreign objects, wire, rope, fencing, etc. that could present a safety hazard.

6.1.5 Security Policy

CH2MHILL policy prohibits the use, possession or storage of any weapon, ammunition or explosive device on company property or in any company vehicle or vehicle being used for company business. No individual may have in his or her possession, bring to the project site, or maintain on CH2M HILL property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All

weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles and/or any CH2M HILL activities or events.

Weapons specified in the CH2MHILL Security/Asset Protection Manual include:

- Firearm, gun, pistol, rifle, or shotgun
- Knife with a blade longer than 3 inches, a switchblade, stiletto, or knife having an automatic spring release device
- Night stick/club/baton, martial arts weapons, bow and arrow or crossbow
- Malicious intent explosive device
- Concealed Weapon

Concealed weapons permit holders are not allowed to bring any weapon to CH2M HILL property or CH2M HILL site, project, office or facility. All project personnel are required to sign-off on the "Weapons Policy" at the back of the HSP.

6.1.6 Steep Slopes and Uneven Walking Surfaces

Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs. Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed. Wear sturdy shoes or boots that provide ankle support.

Stay away from edge of roadways and trails which border steep slopes, uneven ground and rock and shale slopes. "Climbing" in these areas must be avoided and limited to that which does not require climbing equipment. Exercise caution when relying on rocks and trees/tree stumps to support yourself – many times they are loose. Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing. The need for ropes to provide stability should be evaluated and considered as a last resort for ascending or descending slopes.

7. Hazard Communication

As indicated in Section 7 of the Handbook, under "Hazard Communication," the hazard communication (HazCom) coordinator (the SC or qualified designee) must perform the following (additional HazCom duties are outlined in the Handbook):

- Complete an inventory of chemicals brought on site by CH2M HILL using the chemical inventory form included as an attachment to this HSP;
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available;
- Before or as the chemicals arrive on site, obtain a Safety Data Sheet (SDS) for each hazardous chemical and include on the chemical inventory sheet (attached to this HSP) and add the SDS to the SDS attachment section of this HSP;
- Give employees required chemical-specific HazCom training using the chemical-specific training form included as an attachment to this HSP.

8. Contaminants of Concern

The table below summarizes the potential contaminants of concern (COC) and their occupational exposure limit and signs and symptoms of exposure. The table also includes the maximum concentration of each COC and the associated location and media that was sampled (groundwater, soil boring, surface soil). These concentrations were used to determine engineering and administrative controls described in the "Project-Specific Hazard Controls" section of this HSP, as well as PPE and site monitoring requirements.

TABLE 1

Contaminants of Concern

Contaminant	Location and Maximum ^a Concentration	Exposure Limit ^b	IDLH ^c	Symptoms and Effects of Exposure	PIP ^d (eV)
Acetone	GW: 2560 ug/L	1000 ppm	2500 ppm	Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	9.69
Benzene	GW: 1.62 ug/L	1 ppm 5 ppm ST	500 ppm CA	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	9.24
1,2 – Dichloroethylene (cis-1,2-DCE = cis-1,2- Dichloroethene, or trans-)	GW: 77.1 ug/L	200 ppm	1000 ppm	Irritation eyes, respiratory system; central nervous system depression	9.65
Chloroethane (Ethyl Chloride)	GW: 4750 ug/L	1000 ppm	3800 ppm	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	10.9
1,2-Dichloroethane (1,2-DCA)	GW: 3.57 ug/L	50 ppm	50 ppm CA	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	NA
1,1-Dichloroethane	GW: 11,900 μg/L	100 ppm	3000 ppm	Irritation skin; central nervous system depression; liver, kidney, lung damage	11.06
Vinylidene Chloride (1,1-Dichloroethene (1,1-DCE))	GW: 75.7 ug/L	5 ppm	UK	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	10.0
Ethylbenzene	GW: 31.5 ug/L	20 ppm	800 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	8.76
Tetrachloroethylene (PCE)	GW: 28.4 ug/L	25 ppm	150 Ca	Eye, nose, and throat irritation; nausea; flushed face and neck; vertigo; dizziness; sleepiness; skin redness; headache; liver damage	9.32
1,1,1-Trichloroethane	GW: 516 ug/L	350 ppm	700 ppm	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	11.00
Vinyl Chloride	GW: 5.24 ug/L	1 ppm 5 ppm C	UK	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	9.99
TABLE 1 Contaminants of Concern

Contaminant	Location and Maximum ^a Concentration	Exposure Limit ^b	IDLH¢	Symptoms and Effects of Exposure	PIP ^d (eV)
Xylene	GW: 179 ug/L	100 ppm	900 ppm	irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	8,56

Notes:

^a Specify sample-designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), SS (Surface Soil), SL (Sludge), SW (Surface Water).

^b Appropriate value of permissible exposure limit (PEL), recommended exposure limit (REL), or threshold limit value (TLV) listed.

^c IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.

^d PIP = photoionization potential; NA = Not applicable; UK = Unknown.

eV = electron volt

mg/kg = milligram per kilogram

mg/m³ = milligrams per cubic meter

 $\mu g/m^3$ = micrograms per cubic meter

Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of PPE. **Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through use of engineering controls, administrative controls and proper use of respiratory protection when other forms of control do not reduce the potential for exposure.

Other: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

9. Site Monitoring

(Reference CH2M HILL SOP HSE-207, Exposure Monitoring for Airborne Chemical Hazards)

For each task listed in the table below, perform the associated monitoring ensuring the equipment is calibrated daily according to the manufacturer's recommendations. Use the Daily Site Monitoring Form (or equivalent) to document the calibration and the readings taken. Retain area monitoring readings with project records.

Exposure records (breathing zone and personal air sampling) must be preserved for the duration of employment plus thirty years. Copies of all project exposure records (e.g., copies of Daily Site Monitoring form or field logbook pages where breathing zone readings are recorded along with associated calibration) shall be sent to the Sector Safety Program Assistant (SPA) for retention and also maintained in the project files.

Subcontractors are responsible for monitoring and performing integrated personal sampling for their employees as documented in their HSP or, if permitted, according to the table below.

9.1 Direct Reading Monitoring Specifications

Instrument	Tasks	Action Levels ^a	Action to be Taken when A Level reached	ction	Frequency	^b Calibration
Toxic Gas Monitor: MultiRAE Plus with 11.6 eV lamp (VOCs, O ₂ , LEL)	Drilling; Groundwater Sampling; Water/Soil Sampling; O&M Service on ISTT	1 ppm 1-5 ppm >5 ppm 0-10% : 10-25% LEL:	Level D Level C Stop work, let the area ventilate No explosion hazard Potential explosion hazard		Initially & periodically during tasks	Daily
	System	>25% LEL: >25% ^c O ₂ : 20.9% ^c O ₂ : <19.5% ^c O ₂ :	Explosion hazard; evacuate or Normal O_2 O_2 deficient; vent or use SC	vent BA		
Detector Tube: Vinyl Chloride 132 SC 0.1-12 ppm	Drilling; Groundwater Sampling; Water/Soil Sampling; O&M Service on ISTT System	1 ppm >1-5 ppm >5 ppm	Level D Level C (must be approved by RHSM) Level B (must be approved by RHSM)	Initially periodic when PI ppm	and Na ally D >1	ot applicable

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the SC; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

^c If the measured percent of O_2 is less than 10, an accurate LEL reading will not be obtained. Percent LEL and percent O_2 action levels apply only to ambient working atmospheres, and not to confined-space entry. More-stringent percent LEL and O_2 action levels are required for confined-space entry.

^d Noise monitoring and audiometric testing also required.

9.2 Heat Stress Monitoring Flow Chart

Use the flow chart below and refer to the applicable protocol in Section 9 of the Handbook for heat stress monitoring.



Thermal Stress Monitoring Flow Chart

10. Personal Protective Equipment

(Reference CH2M HILL- SOP HSE-117, Personal Protective Equipment, and Section 11 of the Handbook)

10.1 Required Personal Protective Equipment

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM that approved this plan. Refer to the Handbook, Section 11, "Personal Protective Equipment," for requirements on the use, care, and maintenance of PPE.

The table below outlines PPE to be used according to task based on project-specific hazard assessment. If a task other than the tasks described in this table needs to be performed, contact the RHSM so this table can be updated.

Project-Specific Personal Protective Equipment Requirements ^a					
Task	Level	Body	Head	Respirator ^b	
Site Walkthrough; Surveying	D	 Work clothes (sleeved shirt, long pants) Cotton Coveralls Safety-toed Boots Gloves (leather) ANSI/ISEA 107-2010 high visibility vest Other: (specify) 	ANSI Z89.1 Hardhat ^c ANSI Z87.1 Safety glasses Hearing protection ^d	None required	
Drilling; Groundwater Sampling; Water/Soil Sampling; O&M Service on ISTT System	Modified D	 Work clothes Cotton coveralls ANSI/ISEA 107-2010 high visibility vest Safety-toed boots Safety-toed rubber boots (can be deconned in a boot wash) Outer boot covers Inner surgical-style nitrile Outer chemical-resistant nitrile gloves. Chemical protective suit when there will be contact with COC 	ANSI Z89.1 Hardhat ^c ANSI Z87.1 Safety glasses Hearing protection ^d	None required unless indicated by PID and colorimetric tube readings; Must discuss with RHSM	

Reasons for Upgrading or Downgrading Level of Protection (with approval of the RHSM)

	Upgrade ^f		Downgrade
•	Request from individual performing tasks. Change in work tasks that will increase contact or potential contact with hazardous materials. Occurrence or likely occurrence of gas or vapor emission.	•	New information indicating that situation is less hazardous than originally thought. Change in site conditions that decrease the hazard. Change in work task that will reduce contact with
 Known or suspected presence of dermal hazards. Instrument action levels in the "Site Monitoring" section exceeded 			hazardous materials.
a N	^a Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees. ^b No facial hair that would interfere with respirator fit is permitted.		

Project-Specific Personal Protective Equipment Requirements ^a					
Task	Level	Body	Head	Respirator ^b	
^c Hardhat and splash-shield	areas are to be determined b	by the SC.			

^d Ear protection should be worn when conversations cannot be held at distances of 3 feet (1 meter) or less without shouting.

^e See cartridge change-out schedule.

^f Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the RHSM, and an SC qualified at that level is present.

- Each CH2MHILL employee and subcontractor must have and utilize the following equipment and additional items of PPE to reduce heat stress:
 - Personal ice chest, ice, water and electrolyte replacement fluids
 - Personal hydration pack (while hiking)
 - Umbrella (golf, patio or beach umbrella or an EZ-up)
 - Portable chair
 - Water mister bottle
 - Cooling neck bandana with gel
 - Wide brim hard hat with extension
 - Neck capes
 - Lightweight long sleeve shirts

11. Worker Training and Qualification

11.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, Training, and Section 12 of the Handbook)

The following training is required for CH2M HILL personnel working onsite. Copies of training will either be available onsite, or readily available from the CH2M HILL HandS training database system. Refer to Section 12 of the Handbook for a description of HAZWOPER-related and Safety Coordinator training.

Populated CH2M HILL Worker Training	CH2M HILL Task or Equipment-Specific Training			
Required Ch2101 Hill Worker Haining	(if performing task)			
40-hour HAZWOPER Training	Aerial Lift Operator Training			
8-hour HAZWOPER Refresher	Confined Space Entry Training			
3-day HAZWOPER OJT	Excavation Safety Training			
CH2M HILL HSP Training	Fall Protection (site-specific)			
CH2M HILL E&NM HSSE Handbook	Forklift Operator			
CH2M HILL AHAS	Hazard Communication			
Subcontractor HSP	On-Track Railroad Safety Training			
I0-hour OSHA Construction Safety Training	NFPA 70E Training (energized electrical safety training)			
At least one SC-HW (<u>refer to worker category for all applicable</u> <u>training needed</u>)	Qualified Earthmoving Equipment Operator			
HWW (refer to worker category for all applicable training needed)	Scaffold Training			
At least one SC-C (<u>refer to worker category for all applicable</u> <u>training needed</u>)	☐ First Aid/CPR/BBP – at least 2 people			
Other (specify)	Other (specify):			
Project-Specific Required (VO) Training - personnel must check their training records on the				
HandS database to make sure that the following training courses on the VO are current				
Behavior Based-Loss Prevention System (BBLPS) Training (take one time, no expiration)	Hand Safety Training (take one time, no expiration)			
Arsenic Training	Hydrogen Sulfide Hazard Recognition Training			
Asbestos Awareness Training	Ionizing Radiation Training			
Bear Awareness Training	Lead Exposure Training			
🔀 Benzene Training	☐ Lockout/Tagout Training			
🔀 Blood Borne Pathogens (annual requirement)	Manual Lifting Training (take one time, no expiration)			
Chromium Training	Methylene Chloride Training			
Confined Space Awareness Training	Noise Training (annual requirement)			
Drum Handling Training (take one time, no expiration)	PPE (take one time, no expiration)			
Fire Extinguisher Training	Railroad Safety On-line Training			

Required CH2M HILL Worker Training	CH2M HILL Task or Equipment-Specific Training (if performing task)		
Excavation Safety Training	Safe Behavior Observations (take one time, no expiration)		
Fall Protection Training	\boxtimes Stairways and Ladders (take one time, no expiration)		
Formaldehyde Training	Traffic Safety Training		
🛛 Drum Handling Training	🔀 Waste Management (annual requirement)		

The designation of **competent person** is a specific position of knowledge and authority for a particular activity with defined roles and responsibilities and, in some cases, requisite qualifications. When CH2M HILL is self-performing work, a qualified competent person must be designated for certain activities. The following tasks on this project require a competent person. The CH2M HILL project manager or their designee will coordinate with the RHSM to verify that the employee assuming this role has the requisite training and experience to be identified as the competent person.

CH2M HILL Tasks Requiring a Competent Person		
Excavation Competent Person	Lead Competent Person	
Asbestos Competent Person	Other:	
Other:	Other:	

11.2 Subcontractor Worker Training

The following training is required for Subcontractor personnel working onsite. Copies of training shall be available onsite.

Desuised Subsentsector Mexica Tasising	Subcontractor Task or Equipment-Specific Training
Required Subcontractor Worker Training	(required if performing this work)
🛛 40-hour HAZWOPER Training	Aerial Lift Operator Training
🛛 8-hour HAZWOPER Refresher	Asbestos Competent Person
🔀 8-hour HAZWOPER Supervisor	Asbestos Training (Supervisor, Worker)
🔀 3-day HAZWOPER OJT	Confined Space Entry Training
CH2M HILL HSP Training	Certified Crane Operator
Subcontractor AHAs	Crane Assembly/Disassembly Competent Person
Subcontractor HSP	Demolition Competent Person
🔀 10-hour OSHA Construction Safety Training	Excavation Competent Person
🔀 30-hour OSHA Construction Safety Training - Supervisor	Fall Protection (site-specific)
Respiratory Protection Training	Flagger Training
CH2M HILL E&NM HSSE Handbook	S Forklift Operator
🔀 First Aid/CPR/BBP – at least 2 people	Hazard Communication
Other (specify)	🔀 Ladder Safety Training

Required Subcontractor Worker Training	Subcontractor Task or Equipment-Specific Training (required if performing this work)
	Lead Training
	🔀 Lockout/Tagout Training
	On-Track Railroad Safety Training
	NFPA 70E Training (energized electrical safety training)
	🔀 Qualified Drill Rig Operator
	🔀 Qualified Earthmoving Equipment Operator
	🔀 Qualified Rigger
	🔀 Qualified Crane Signaler
	Scaffold Training
	Other (specify):

The designation of **competent person** is a specific position of authority for a particular activity with defined roles and responsibilities and, in some cases, requisite qualifications. The Subcontractor must designate a qualified competent person for the following tasks, and supporting documentation (e.g. training documentation, resume of experience, activity competent person designation is granted for, etc.) must be available for CH2M HILL review upon request.

Subcontractor Tasks Requiring a Competent Person

Excavation Competent Person	Lead Competent Person
Asbestos Competent Person	Other:
Scaffolding Competent Person	Other:
Crane Competent Person	Other:

11.3 HAZWOPER-Exempted Tasks

The following tasks are not within the scope of the HAZWOPER standard so HAZWOPER training is not required for workers performing these tasks:

Tasks	Controls
Access Agreement and Notifications	Brief on hazards, limits of access, and emergency procedures.
Site Walkthrough	Post areas of contamination as appropriate.
Daily mobilization/demobilization	Perform air sampling/monitoring as specified in this HSP.
Preparing samples for shipment to laboratory	
Utility Clearance and Surveying	

12. Medical Surveillance and Qualification

(Reference CH2M HILL SOP HSE-113, Medical Surveillance, and Section 13 of the Handbook)

The following medical surveillance is required for CH2M HILL and subcontractor personnel working onsite. Copies of physician's medical opinion will either be available onsite, or for CH2M HILL staff, readily available from the CH2M HILL HandS training database system. Refer to Section 13 of the Handbook for a description of HAZWOPER, respirator user, and hearing conservation medical surveillance.

General Required Medical Surveillance	Job or Activity-Specific Medical Surveillance (required if performing this work)
HAZWOPER Medical Clearance	Noise
Respirator Medical Clearance	Baseline Blood Lead
	Asbestos Medical Clearance
	Other (specify):

Personnel or Tasks Not Requiring Medical Surveillance	
Access Agreement and Notifications	Brief on hazards, limits of access, and emergency procedures.
Site Walkthrough	Post areas of contamination as appropriate.
Daily mobilization/demobilization	Perform air sampling/monitoring as specified in this HSP.
Preparing samples for shipment to laboratory	
Utility Clearance and Surveying	

13. Site-Control Plan

(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations, and Section 14 of the Handbook)

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas. Task-specific control measures are listed below. Use of the Buddy System will be implemented unless a Working Alone protocol has been established and approved as indicated in Sections 5 and 6 above.

Site Control for General Work Area(s)			
Perimeter fencing	Location:	Barricades	Location:
🔀 Signage	Location: NFPA label on chemical storage tanks; label all drums	Other: traffic cones	Location: Identify EZ/CRZ
Traffic control devices	Location:	Other:	Location:
Location	Site Control Procedure (discuss in required s	nportant elements such as signs, baund of the second second second second second second second second second se name of the second s	arricades, briefings, qualifications, t logs, etc.)
Support Zone	NA		

Contamination Reduction Traffic Cones and caution tape Zone

Exclusion Zone

Traffic Cones and caution tape

14. Decontamination

(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations, and Section 15 of the Handbook)

Refer to the Handbook, Section 15, "Decontamination," for a complete description of decontamination activities and diagrams of typical decontamination areas. Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones.

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with project plans.

Type of Decon	Activity	Equipment	Process/Protocol
Personnel	⊠ Drilling, Soil Sampling , decon	 Tubs/brushes for boot/glove wash Solids disposal bag or drum (used PPE) Liquid disposal drum (decon water) 	 Boot wash/rinse PPE disposal (no decon) PPE waste area identified Other:
Equipment	⊠ Drilling, Soil Sampling, decon	 Table for equipment decon/staging Decon pad for vehicles Pressure Washer PPE used during decon Decon supplies (brushes, brooms) Containers/method to capture decon water and or sludge 	 Equipment wiped/cleaned before leaving CRZ Vehicle tires dry deconned prior to leaving site Vehicle tires washed prior to leaving site Other: Sampling equipment decon supplies

14.1 Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

15. Communications

A primary and backup means of communication for field crews have been established as described below:

Type of Communication	Primary Means	Backup Means
Communication between field crew	🛛 Voice	Uvice
	🗌 Radio	🗌 Radio
	🔀 Phone	🔀 Phone
Communication with Fire and Emergency	🗌 Radio	🗌 Radio
Services	🔀 Phone	🔀 Phone

16. Required Facilities and Equipment

The following facilities and equipment are required and used for safe completion of work:

TABLE 16-1

Required Facilities and Equipment for Safe Completion of Work

Emergency Equipment and Supplies	Location
First aid kit	Field Vehicle
Eye wash	Field Vehicle
Potable water (ice chest, ice, water and electrolytes; warm	Field Vehicle
fluids during cold weather)	
Bloodborne-pathogen kit	Field Vehicle
Additional Equipment: cell phone, sun screen, clothing and emergency supplies for extreme weather conditions	Field Vehicle

17. Emergency Response Plan

(Reference CH2M HILL SOP HSE-106, Emergency Planning, and Section 16 of the Handbook)

Personnel responsible for coordinating emergency situations during site activity are identified below. The Emergency Contacts Page is at the front of this Plan. A site map showing assembly points and directions to the authorized medical facility is attached. Documented rehearsal and critique of this plan is required at least once during the task, or more often as necessary.

Responsibility	Name	Phone Number(s)
Emergency Response Coordinator (ERC)	Jayson Burkard	(314) 335-3046; cell (314) 477-7284
Alternate ERC	Jayson Burkard	(314) 335-3046; cell (314) 477-7284
Type (desk or field) and frequency of rehearsal	Drive the hospital route prior to beginning site activities; discuss emergency response procedures during the morning tailboard	

If an emergency situation develops which requires evacuation of the work area, the following steps shall be implemented.

Evacuation Step	Methods and comments:
Notify affected workers	Voice
Evacuate to safe location	Walk / vehicle
Assemble and account for workers	PTSP form
Notify Supervisor/Manager	Cell
Complete incident report	Online

Potential emergency situations and response actions are identified below.

In case of:	Response actions:
Injury or illness	911 or Occ Nurse for non-medical emergencies
Chemical exposure	Notify HSM within 1 hour
Fire or explosion	Call 911
Adverse weather	Tornado warning – evacuate to fixed facility
Heat Stroke	Call 911, have a designee give location and directions to ambulance service if needed. If CH2M HILL employee, call occupational physician at 1-866-893-2514.
Material spill or release	Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations, when safe to do so.

Evacuation Signals:	Meaning:
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

In the event of a **large quantity spill** notify emergency services. Personnel discovering a spill shall (only if safe to do so):

- Stop or contain the spill immediately (if possible) or note source. Shut off the source (e.g., pump, treatment system) if possible. If unsafe conditions exist, then leave the area, call emergency services, inform nearby personnel, notify the site supervisors, and initiate incident reporting process. The SC shall be notified immediately;
- Extinguish sources of ignition (flames, sparks, hot surfaces, cigarettes);
- Clear personnel from the spill location and barricade the area;
- Use available spill control equipment in an effort to ensure that fires, explosions, and releases do not occur, recur, or spread;
- Use sorbent materials to control the spill at the source;
- Construct a temporary containment dike of sorbent materials, cinder blocks, bricks or other suitable materials to help contain the spill;

- Attempt to identify the character, exact source, amount, and extent of the released materials.
 Identification of the spilled material should be made as soon as possible so that the appropriate cleanup procedure can be identified;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- Assess possible hazards to human health or the environment as a result of the release, fire or explosion; and
- Follow incident notification, reporting, and investigation section of this plan.

18. Incident Notification, Reporting, and Investigation

(Reference Section 16 of the Handbook for complete definitions and protocol)

18.1 Incident Notification

All employees and subcontractors' employees shall immediately report any incident (including "near misses,") in which they are involved or witness to their supervisor.

The CH2M HILL or Subcontractor supervisor, upon receiving an incident report, shall inform his immediate superior and the CH2M HILL SC.

The SC shall immediately report the following information to the RHSM and PM by phone and e-mail:

- Project Name and Site Manager;
- Date and time of incident;
- Description of incident;
- Extent of known injuries or damage;
- Level of medical attention; and
- Preliminary root cause/corrective actions

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required.

18.2 Drug and Alcohol Testing for CH2M HILL Employees

As required by CH2M HILL Policy 810, U.S. Employees are subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury in which the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor;
- Incident resulting in property damage over USD\$500 as determined by the Company;
- Injury on or in Company Property/Workplace (to Employee or third parties) involving the Employee's use of heavy machinery as determined by the Company;

- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the Company and where the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor to the serious near miss injury;
- Other circumstances as dictated by Employee Relations; or
- An Employee contributes to any of the above.

Refer to the E&NM HSSE Handbook and CH2M HILL Policy 810 for additional information and specific requirements.

18.3 Drug and Alcohol Testing for Subcontractors

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

18.4 HITS System and Incident Report Form

The SC shall complete an entry into the Hours and Incident Tracking System (HITS) database system located on CH2M HILL's Virtual Office (or if VO not available, use the hard copy Incident Report Form and Root Cause Analysis Form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

18.5 Injury Management/Return-to-Work (for US/Puerto Rico based CH2M HILL Staff Only)

In the event of an injury, or potential injury (i.e., involvement in motor vehicle collision with no apparent injury; a puncture wound with no bleeding or apparent infection, etc.), the following actions shall be taken:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-866-893-2514 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week. Employees are encouraged to enter this phone number into their cell phones prior to starting field work.
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SC accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- Supervisor or SC completes the HITS entry or Incident Report Form immediately (within 24 hours) and forwards it to the Project Manager and RHSM.
- Nurse notifies appropriate CH2M HILL staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor ensures medical limitations prescribed (if any) by physician are followed until the worker is released to full duty.

18.6 Serious Incident Reporting Requirements

Serious incidents include the following:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or • member of the public;
- Kidnap or missing person; •
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to • result in greater than \$ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to • site workers, neighboring facilities, the community or the environment.

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.

19. Inspections

19.1 Project Activity Self-Assessment Checklists

The following self-assessment checklists are required when the task or exposure is initiated and weekly thereafter. The checklists shall be completed by the SC or other CH2M HILL representative and maintained in project files.

Biological safety Crane Safety Drilling Safety Electrical Safety Earthmoving Equipment Forklift Safety Hand and Power Tools Hazardous Materials Handling Heat stress physiological monitoring form LO/TO Manual Lifting **Personal Protective Equipment**

19.2 Safe Behavior Observations

The SC or designee shall perform at least one SBO each week for any field work performed by subcontractors or when there are at least two CH2M HILL personnel performing field work.

E-mail completed forms to:

Commercial Sector: CH2M HILL ES COM Safe Behavior Observation

19.3 Agency Inspections

If a Federal or local agency (e.g., OSHA, local water board, EPA) announces it will be performing inspection, either announced or unannounced, refer to Attachments, Target Zero Bulletin on Agency Inspections. Contact the PM, RHSM and EM as soon as you receive notice.

Refer to the Handbook, Section 19, "Records and Reports," for a complete description of HSE recordkeeping requirements. Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), SDSs, exposure modeling results
- Training records
- Respiratory fit test records
- Incident reports, investigations and associated backup information
- Federal or state agency inspection records
- HSE audits and assessments
- Confined space entry permits
- Waste profiles
- Agency submittals

- Equipment inspections
- Equipment maintenance
- Emergency equipment inspection records
- SBOs
- Self-assessment checklists
- Daily Safety Meeting Sign-In forms/PTSPs
- Waste analytical data
- Manifests
- Reports and certifications

21. Employee Signoff Form

EMPLOYEE SIGNOFF FORM

Health and Safety Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name:	Project Number:		
EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

CH2MHILL Project-Specific Security Policy

CH2MHILL Weapons Policies

The following policies apply to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors working on CH2MHILL projects.

Project-Specific Weapons Policy

No individual may have in his or her possession, bring the project site, or maintain on CH2MHILL property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles, and/or any CH2MHILL activities or events. This policy applies to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors. Weapons specified in CH2MHILL's Security/Asset Protection Manual include:

- Firearm, gun, pistol, rifle, or shotgun
- Knife with a blade longer than 3 inches, a switchblade, stiletto, or knife having an automatic spring release device
- Night stick/club/baton, martial arts weapons, bow and arrow, or crossbow
- Malicious intent explosive device
- Concealed weapon^{**}

" Concealed weapons permit holders are not allowed to bring any weapon to CH2MHILL property, project site, office or facility.

CH2MHILL Project-Specific Knife Policy

CH2MHILL policy prohibits having any fixed open bladed knives on CH2MHILL project sites. Scissors or auto-retractable safety knives are the only allowed tools for cutting. This policy regarding knives applies to all CH2MHILL staff and contingent staff, and CH2MHILL subcontractors.

Acknowledgment

By signing below, you are acknowledging that you have been given a copy of the company's weapons policy and the project specific weapons policy, have read and understand the requirements of the policies, agree to comply with all of its requirements, and understand that noncompliance with either of these policies will result in disciplinary action, up to and including termination for CH2MHILL employees and revocation of project/site access for CH2MHILL subcontractor employees.

Check One:

CH2MHILL Employee	
🗆 Other (Company Name):	

Project Name:

Signature

CH2MHILL Employee Number

Printed Name

Date

Witness Signature

(Please have someone sign that they did witness you signing this form.)

CH2M HILL Health and Safety Plan Attachment 1

HSSE Handbook

Environment & Nuclear Business Group

Health, Safety, and Environment Handbook

January 7, 2015



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Employee Sign-Off Form Subcontractor Sign-Off Form

1. Introduction

1.1 CH2M HILL Health, Safety, and Environment Policy Commitment and Goals

1.1.1 Health, Safety, and Environment Policy Commitment

Protection of people and the environment is a CH2M HILL core value. It is our vision to create a culture that empowers employees to drive this value into all global operations and achieve excellence in health, safety, and environment (HSE) performance. CH2M HILL deploys an integrated, enterprise-wide behavior based HSE management system to fulfill our mission and the expectations of our clients, staff, and communities based on the following principles:

- We require all management and supervisory personnel to provide the leadership and resources to inspire and empower our employees to take responsibility for their actions and for their fellow employees to prevent injuries, illnesses, and adverse environmental impacts, and create a safe, healthy, and environmentally-responsible workplace.
- We provide value to clients by tailoring HSE processes to customer needs and requiring CH2M HILL employees and subcontractors to deliver projects that identify HSE requirements and commit to compliance with applicable HSE laws and regulations, company standards, and external requirements.
- We are committed to pollution prevention in conjunction with our Sustainability Policy and by offering our clients sustainable solutions.
- We aspire to continually improve our performance and influence others to redefine world-class HSE excellence.
- We evaluate our design engineering and physical work environment to verify safe work conditions and practices are established, followed, and corrected as needed.
- We assess and continually improve our HSE program to achieve and maintain world-class performance by setting and reviewing objectives and targets, reporting performance metrics, and routinely evaluating our program.
- We expect all employees to embrace our Target Zero culture, share our core value for the protection of people and the environment, understand their obligations, actively participate, take responsibility, and "walk the talk" on and off the job.

1.1.2 Project-Specific Health, Safety, and the Environment Goals

All management and employees are to strive to meet the project-specific Health, Safety, and the Environment (HSE) goals outlined below. The team will be successful only if everyone makes a concerted effort to accomplish these goals. The goals allow the project to stay focused on optimizing the health and safety of all project personnel and, therefore, making the project a great success.

The E&NBG has established eleven specific goals and objectives:

- Create an injury-free environment;
- Have zero injuries or incidents;
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example;
- Ensure effective implementation of the project safety plan, environmental plan (or equivalent) through education, delegation, and team work;
- Ensure 100 percent participation in HSE compliance;

- Continuously improve our safety and environmental performance;
- Maintain free and open lines of communication;
- Make a personal commitment to safety as a value;
- Focus safety improvements on high-risk groups;
- Continue strong employee involvement initiatives; and
- Achieve health, safety, and environmental excellence.

2. Applicability

This Environment & Nuclear Business Group (E&NBG) Health, Safety, Security, and Environment Handbook (Handbook) applies to:

- All CH2M HILL staff supporting E&NBG projects, including subcontractors and tiered subcontractors of CH2M HILL working on the site; and
- All visitors to the construction or remediation site in the custody of CH2M HILL (including visitors from the Client, the Government, the public, and other staff of any CH2M HILL company).

This Handbook does not apply to the third-party contractors, their workers, their subcontractors, their visitors, or any other persons not under the direct control or custody of CH2M HILL. This document does not apply to LLC companies within the E&NBG.

This Handbook defines the procedures and requirements for the health and safety of CH2M HILL staff and visitors when they are physically on the work site. The work site includes the project area (as defined by the contract documents) and the project offices, trailers, and facilities thereon.

This Handbook will be kept onsite during field activities and will be reviewed as necessary. The Handbook will be amended or revised as project activities or conditions change or when supplemental information becomes available. The Handbook adopts, by reference, the Enterprise-wide Core Standards and Standard Operating Procedures (SOPs), as appropriate. In addition, the Handbook may adopt procedures from the project Work Plan and any governing regulations. If there is a contradiction between this Handbook and any governing regulation, the more stringent and protective requirement shall apply.

This Handbook incorporates the regulatory requirements described in the State of California OSHA agency – Cal/OSHA Title 8 CCR, Section 3203, Injury and Illness Prevention Program (IIPP), and section 1509, Construction Injury and Illness Prevention Program. The current version of <u>CH2M HILL Cal/OSHA IIPP written program</u> can be accessed on the HSE website under Programs.

All CH2M HILL staff and subcontractors must sign the employee sign-off form included at the end of this Handbook to acknowledge review of the document. CH2M HILL employees will send a signed copy of the sign-off form to their SPA. The subcontractor sign-off form will be maintained on site by the project Safety Coordinator (SC).

Roles and Responsibilities 3.

The sections below describe the roles and responsibilities of personnel referred to in the project-specific safety plan.

CH2M HILL Project Manager 3.1

The project manager (PM) is responsible for providing adequate resources (budget and staff) for project-specific implementation of the HSE management process. The PM has overall management responsibility for the tasks listed below. The PM may explicitly delegate specific tasks to other staff, as described in sections that follow, but retains ultimate responsibility for completion of the following in accordance with this document and applicable safety plans:

- Coordinate and lead Subcontractor HSE Chartering meetings prior to the start of field work; •
- Ensure CH2M HILL safety plan is current and provide approval alongside the RHSM. •
- Ensure CH2M HILL Activity Hazard Analyses (AHAs) are in place and verify RHSM has reviewed and approved; •
- Notify HSE staff if changes to scope have an effect on HSE plans, documents, or requirements; review and • approve any field change requests (FCRs) to the safety plan.
- Ensure copies of training and medical monitoring records, and site-specific safety procedures are being • maintained in the project file accessible to site personnel;
- Provide oversight of subcontractor HSE practices per the site-specific safety plans and procedures; •
- Manage the site and interfacing with 3rd parties in a manner consistent with the contract and subcontract • agreements and the applicable standard of reasonable care;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented; •
- Perform a Management Inspection at least once during short-term projects or once a month on long-term • projects;
- Provide visible support and motivation for HSE programs, rules, procedures, processes, and training, leading by • example and encouraging CH2M HILL employees to take ownership of HSE issues;
- Intervene or stop work when an unsafe condition or behavior is observed, and/or when an environmentally • compromising condition is encountered;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on • project work sites;
- Promptly report all work-related HSE incidents or near misses; •
- Conduct, cooperate, or assist with HSE incident investigations; •
- Wear any required personal protective equipment when visiting project site; •
- Consult with the Human Resources Delivery Partner before taking any disciplinary action (other than verbal • counseling) associated with CH2M HILL Policy 203 and/or HSE programs rules, procedures, processes and training.

CH2M HILL Responsible Health and Safety Manager 3.2

The Responsible Health and Safety Manager (RHSM) is assigned by the BG HSE Lead or designee to provide ongoing health and safety technical guidance and support to the project, program or facility. The RHSM is responsible for the following:

- Approve HSP and revisions or amendments as well as AHA(s);
- Review and accept subcontractor training and medical monitoring records prior to start of field operations;
- Review and accept subcontractor site-specific safety procedures for adequacy prior to start of subcontractor's field operations;
- Provide input to the PM on the selection of the SC;
- Support the oversight (or SC's direct oversight) of subcontractor and tiered subcontractor HSE practices;
- Permit upgrades and downgrades in personal protective equipment (PPE), including respiratory protection, in accordance with the site safety plan;
- Conduct audits as determined by project schedule and coordination with PM; and
- Participate in incident investigations, lessons learned, loss and near loss reporting.

3.3 CH2M HILL Project Environmental Manager

The Project EM is responsible for the following:

- Provide environmental program support in areas such as training, auditing, planning, permit tracking, and subcontractor oversight as needed or as specified in the project environmental plan or equivalent plan;
- Assist the PM to identify environmental requirements, including those described in the HSE Management System Manual (ES-S01-01P), environmental risks, environmental permits and similar documents that CH2M HILL is responsible for complying with (e.g., notices, approvals or other documents that legally bind CH2M HILL);
- Verify that a FPSF has been submitted and that an Environmental Plan or equivalent document is available;
- Assist the PM in preparing or coordinating the preparation of regulatory-required environmental plans (e.g., SPCC, SWPPP) and contract-required environmental plans (e.g., Environmental Protection Plan);
- Review revised scopes of work and changes in project conditions to identify new environmental issues and requirements;
- Review/approve waste characterizations and Client waste profiles, or engage E&NBG Waste Coordinator to review and approve;
- Evaluate any spills, releases, or environmental permit incidents for appropriate follow-up actions, notifications, and recordkeeping requirements; and
- Provide environmental compliance and environmental management expertise, advice, and training to the project team as needed during the course of the project.

3.4 CH2M HILL Safety Coordinator

The SC is responsible for verifying that the project is conducted in a safe manner including the following specific obligations:

- Participate in Subcontractor HSE Chartering meetings prior to the start of field work;
- Verify the project safety plan is current and amended when project activities or conditions change;
- Verify CH2M HILL site personnel and subcontractor personnel read this Handbook, the project safety plan, and applicable AHAs and sign the accompanying sign-off forms for each, prior to commencing field activities;
- Verify CH2M HILL site personnel have completed any required specialty training (for example, fall protection, confined space entry, among others) and medical surveillance as identified in the project safety plan;

- Verify that project files include copies of accepted subcontractor training and medical monitoring records, and accepted site-specific safety procedures prior to start of subcontractor's field operations;
- Act as the project "Hazard Communication Coordinator" and perform the responsibilities outlined in the project safety plan;
- Act as the project "Emergency Response Coordinator" and perform the responsibilities outlined in the project safety plan;
- Post the Occupational Safety and Health Administration (OSHA) job-site poster; the poster is required at sites where project field offices, trailers, or equipment-storage boxes are established. If you work in a state with an OSHA State Plan, make sure the State Plan poster is posted, if required;
- Hold and/or verify that safety meetings are conducted and documented in the project file initially and as needed throughout the course of the project (as tasks or hazards change);
- Assist in implementing environmental plan requirements at the project as assigned by the PM or project EM.
- Verify that project health and safety forms and permits are being used as outlined in the project safety plan;
- Perform oversight and assessments of subcontractor HSE practices per the site-specific safety plan and verify that project activity self-assessment checklists are being used as outlined in the project safety plan;
- Coordinate with the RHSM regarding CH2M HILL and subcontractor operational performance, and 3rd party interfaces;
- Verify appropriate personal protective equipment (PPE) use, availability, and training;
- Ensure that the overall, job-specific, HSE goals are fully and continuously implemented;
- Calibrate and conduct air monitoring in accordance with the project safety plan; maintain all air monitoring records in project file;
- Maintain HSE records and documentation at the project site;
- Facilitate OSHA or other government agency inspections including accompanying inspector and providing all necessary documentation and follow-up;
- Deliver field HSE training as needed based on project-specific hazards and activities;
- Consistently and even-handedly enforce HSE rules, procedures, and requirements at the office and/or on project work sites;
- Wear any required personal protective equipment;
- Contact the RHSM and PM in the event of an incident;
- Contact the RHSM and Project EM in the event of a spill or release immediately so evaluation of reportable quantity requirements and whether agency reporting is required;
- Conduct, cooperate, or assist with HSE incident investigations;
- Contact the PM and RHSM when standards of conduct or CH2M HILL Policy 203 has been violated by a CH2M HILL employee;
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, stop affected work until adequate corrective measures are implemented, and notify the PM and RHSM as appropriate; and
- Document all verbal health and safety-related communications in project field logbook, daily reports, or other records.

3.5 CH2M HILL Employees

All personnel are assigned responsibility for safe and healthy operations. This concept is the foundation for involving all employees in identifying hazards and providing solutions. For any operation, individuals have full authority to stop work and initiate immediate corrective action or control. In addition, each worker has a right and responsibility to report unsafe conditions or practices. This right represents a significant facet of worker empowerment and program ownership. Through shared values and a belief that all incidents are preventable, our employees accept personal responsibility for working safely.

Each employee is responsible for the following performance objectives:

- Understanding and abiding by CH2M HILL and client HSE programs, rules, procedures, processes, and training, including any that are project-specific;
- Completing all required HSE training made available and accessible within established timelines;
- Always wearing any required personal protective equipment;
- Intervening or stopping work for you or other CH2M HILL employees when an unsafe condition or behavior is encountered or observed, and/or when an environmentally compromising condition exists;
- Promptly notifying a supervisor, PM, SC, or RHSM when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition exists;
- Promptly reporting a supervisor, PM, SC, or RHSM all work-related health, safety, and environmental incidents or near misses;
- Attending required project HSE pre-task briefings and meeting prior to performing work; and
- Cooperating or assisting with HSE incident investigations.

3.5.1 Employee Authority

Each employee on the project has the obligation and authority to shut down any perceived unsafe work and during employee orientation, each employee will be informed of their authority to do so.

3.6 CH2M HILL Subcontractors

Subcontractors must comply with the following activities, and are responsible to:

- Participate in Subcontractor HSE Chartering meetings;
- Comply with all local, state, and federal safety standards;
- Comply with project and owner safety requirements;
- Subcontractor shall maintain up to date health and safety training, medical, and competent person qualification records at the project site, readily available for inspection.
- Actively participate in the project safety program and either hold or attend and participate in all required safety meetings;
- Provide a qualified safety representative to interface with CH2M HILL;
- Maintain safety equipment and PPE for their employees;
- Maintain and replace safety protection systems damaged or removed by the subcontractor's operations;
- Notify the SC of any incidents including, injury, spills or releases, environmental permit issues, near misses or property damage immediately and submit reports to CH2M HILL within 24 hours;

- Install contractually required general conditions for safety (for example, handrail, fencing, fall protection systems, floor opening covers);
- Conduct and document weekly safety inspections of project-specific tasks and associated work areas;
- Conduct site-specific and job-specific training for all subcontractor employees, including review of the CH2M HILL safety plan, subcontractor safety plans, and subcontractor AHAs and sign appropriate sign-off forms; and
- Determine and implement necessary controls and corrective actions to correct unsafe conditions.

Subcontractors may be required to submit their own site-specific safety plan and other plans such as lead or asbestos abatement compliance plans. Subcontractors are responsible for the health, safety, and environment procedures specific to their work, and are required to submit their plans to CH2M HILL for review and acceptance before the start of field work.

Subcontractors are also required to prepare AHAs before beginning each activity posing hazards to their personnel. The AHA shall identify the principle steps of the activity, potential health and safety hazards for each step and recommended control measures for each identified hazard. In addition, a listing of the equipment to be used to perform the activity, inspection requirements, and training requirements for the safe operation of the equipment listed must be identified.

3.7 Client Contractors

CH2M HILL project safety plans do not cover contractors that are contracted directly to the client or the owner. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (such as advising on health and safety issues). In addition to these instructions, CH2M HILL team members should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Self-assessment checklists are to be used by the SC and CH2M HILL team members to review the contractor's performance only as it pertains to evaluating CH2M HILL exposure and safety. The RHSM is the only person who is authorized to comment on or approve contractor safety procedures.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL team members on the precautions related to the contractor's work;
- When an apparent contractor non-compliance or unsafe condition or practice poses a risk to CH2M HILL team members:
 - Notify the contractor safety representative;
 - Request that the contractor determine and implement corrective actions;
 - If necessary, stop affected CH2M HILL work until contractor corrects the condition or practice; and
 - Notify the client, PM, and RHSM as appropriate.

If apparent contractor non-compliance or unsafe conditions or practices are observed, inform the contractor safety representative (CH2M HILL's obligation is limited strictly to informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative (CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of the observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions).

All verbal health and safety-related communications will be documented in project field logbook, daily reports, or other records.

All individuals associated with this project must work injury-free and drug-free and must comply with the following standards of conduct, and the safety requirements of CH2M HILL. Commonly accepted standards of conduct help maintain good relationships between people. They promote responsibility and self-development. Misunderstandings, frictions, and disciplinary action can be avoided by refraining from thoughtless or wrongful acts.

4.1 HSE Accountability

(Reference CH2M HILL Policy 203, HSE Accountability)

4.1.1 Prohibited Behaviors and Actions

Managers, supervisors, and employees who openly or recklessly exhibit a disregard, defiance, or disrespect for CH2M HILL's HSE programs, rules, procedures, processes, and training, or who violate established HSE programs, rules, procedures, procedures or other employees, will be subject to disciplinary actions. Without limitation, behaviors and actions that warrant disciplinary action include the following:

- Requiring, requesting, demanding, asking, or threatening another person in any manner to entice the person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Condoning or knowingly allowing a person to engage in or work around a patently unsafe or environmentally compromising act or condition.
- Recklessly, knowingly, or purposely failing to wear required personal protective equipment.
- Failing to successfully complete any required HSE training that is scheduled and made available for completion.
- Failing to promptly notify a supervisor, project safety manager, coordinator, lead, or the project manager when an unsafe condition or behavior is observed, and/or when an environmentally compromising condition is encountered.
- Failing to promptly report to a supervisor, project safety manager, coordinator, lead, or the project manager, a work-related HSE incident or near miss.
- If required of the position, failing to maintain as active and in good standing necessary health, safety, and/or environmental licenses or permits needed to support CH2M HILL work and projects.
- Knowingly falsifying any HSE record or investigative document (whether internal to CH2M HILL or external), or providing false testimony, during an HSE or outside agency incident investigation.
- Refusing to cooperate in an HSE incident investigation.
- Knowingly falsifying any inspection or sampling records (whether internal to CH2M HILL or external).
- Performing field work without the required site HSE plan approved by a HSE manager.
- Engaging in any form of workplace violence described in Policy 201 Workplace Violence Awareness and Prevention, including physical encounters, destruction of property, and verbal threats of violence, harm, or mayhem.
- Failing to comply with any HSE procedures contained in any contract, subcontract, site health safety and environment plan, or any federal, state, or local health, safety, or environmental laws and regulations creating actual or potential significant risk for CH2M HILL (whether monetary or otherwise).

In addition, no individual may have in his or her possession, bring to the project site, or maintain on CH2M HILL property, concealed or otherwise, any weapon, explosive device or substance, firearm, ammunition or instrument that could be used as a weapon. All weapons, explosive devices or substances, firearms, and ammunition are banned from all project sites, properties, vehicles and/or any CH2M HILL activities or events.

4.1.2 Disciplinary Actions

When CH2M HILL employees neglect to fulfill their responsibilities and/or project-specific HSE requirements, CH2M HILL may discipline its employees. All CH2M HILL employees, including management and supervisory employees, are equally subject to disciplinary action for failing to meet the expectations associated with this Policy and/or HSE programs, rules, procedures, processes, and training. CH2M HILL reserves the right in its sole discretion to determine the appropriateness of any discipline imposed, but such disciplinary action may include, without limitation, denial of access to the worksite, verbal and/or written warnings/reprimands, and termination of employment.

4.2 Subcontractor Safety Performance

CH2M HILL should continuously endeavor to observe subcontractors' safety performance and adherence to their plans and AHAs. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

4.2.1 Observed Hazard Form

When apparent non-compliance or unsafe conditions or practices are observed, notify the subcontractor's supervisor or safety representative verbally, and document using the Observed Hazard Form, included as an attachment to the project safety plan, and require corrective action.

If necessary, stop subcontractor's work using the Stop Work Order Form until corrective actions is implemented for observed serious hazards or conditions. Update the Observed Hazard Form to document corrective actions have been taken. The subcontractor is responsible for determining and implementing necessary controls and corrective actions.

4.2.2 Stop Work Order

CH2M HILL has the authority, as specified in the contract, and the responsibility to stop work in the event any CH2M HILL employee observes unsafe conditions or failure of the subcontractor to adhere to its safe-work practices, or observes a condition or practice that may result in a release or violation of an environmental requirement. This authority and action does not in any way relieve the subcontractor of its responsibilities for the means and methods of the work or, therefore, of any corrective actions. Failure to comply with safe work practices can be the basis for restriction or removal of the subcontractor staff from the job site, termination of the subcontract, restriction from future work, or all three.

When an apparent imminent danger is observed, immediately stop work and alert all affected individuals. Remove all affected CH2M HILL employees and subcontractor staff from the danger, notify the subcontractor's supervisor or safety representative, and do not allow work to resume until adequate corrective measures are implemented. Notify the PM, Contract Administrator (KA) and RHSM.

When repeated non-compliance or unsafe conditions are observed, notify the subcontractor's supervisor or safety representative and stop affected work by completing and delivering the Stop Work Order Form (attached to the project safety plan) until adequate corrective measures are implemented. Consult the KA to determine what the contract dictates for actions to pursue in event of subcontractor non-compliance including work stoppage, back charges, progress payments, removal of subcontractor manager, monetary penalties, or termination of subcontractor for cause.
4.3 Incentive Program

Each project is encouraged to implement a safety incentive program that rewards workers for exhibiting exemplary safety behaviors. Actions that qualify are those that go above and beyond what is expected. Actions that will be rewarded include spotting and correcting a hazard, bringing a hazard to the attention of your foreman, telling your foreman about an incident, coming up with a safer way to get the work done, or stopping a crew member from doing something unsafe. The program will operate throughout the project, covering all workers. The incentive program will be communicated to all employees during the project employee orientation and project safety meetings.

4.4 Reporting Unsafe Conditions/Practices

Responsibility for effective health and safety management extends to all levels of the project and requires good communication between employees, supervisors, and management. Incident prevention requires a pro-active policy on near misses, close calls, unsafe conditions, and unsafe practices. All personnel must report any situation, practice, or condition which might jeopardize the safety of our projects. All unsafe conditions or unsafe practices will be corrected immediately. CH2M HILL has zero tolerance of unsafe conditions or unsafe practices.

No employee or supervisor will be disciplined for reporting unsafe conditions or practices. Individuals involved in reporting the unsafe conditions or practices will remain anonymous.

The following reporting procedures will be followed by all project employees:

- Upon detection of any unsafe condition or practice, the responsible employee will attempt to safely correct the condition;
- The unsafe condition or practice will be brought to the attention of the worker's direct supervisor, unless the unsafe condition or practice involves the employee's direct supervisor. If so, the SC needs to be notified at once by the responsible employee;
- Either the responsible employee or responsible employee's direct supervisor is responsible for immediately reporting the unsafe condition or practice to the SC;
- The SC will act promptly to correct the unsafe condition or practice; and
- Details of the incident or situation will be recorded by the SC in the field logbook or use the Observed Hazard Form if subcontractor was involved.

5.1 Subcontractor HSE Chartering Meeting

A subcontractor HSE chartering meeting shall be held with subcontractors performing field work on the project. The purpose of the meeting is to discuss and agree on key HSE requirements on a project, and to emphasize and reinforce CH2M HILL expectations for subcontractor HSE performance. The target audience includes key CH2M HILL project staff with HSE responsibilities (e.g., PM, RHSM, SC, Field Team Leader (FTL)) and key Subcontractor staff (e.g., project manager, supervisors, designated field HSE contact, drill team leads, foreman). For small scale projects (e.g., small drill crew and limited CH2M HILL staff), all the subcontractor crew members should attend if available. The meeting should be held prior to mobilization with enough time to ensure that HSE issues identified can be addressed prior to the start of work. The meeting can be held over the phone or in person depending on project needs. An example agenda can be found in the E&NBG Program Element Guideline, "Subcontractor HSE Chartering Meeting."

5.2 Daily Safety Meetings and Pre-Task Safety Plans

Daily safety meetings are to be held with all project personnel in attendance to review the hazards posed and required HSE procedures and AHAs that apply for each day's project activities. The Pre-Task Safety Plans (PTSPs) serve to supplement these general assembly safety meetings; the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews.

At the start of each day's activities, the crew supervisor completes the PTSP, provided as an attachment to the project safety plan, with input from the work crew. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required HSE procedures, as identified in this Handbook and AHA. The use of PTSPs promotes worker participation in the hazard recognition and control process while reinforcing the task-specific hazard and required HSE procedures with the crew each day. The PTSP can be completed either with the daily safety meeting or, if there are multiple crews, separately with each crew and their supervisor after the general daily safety meeting.

5.3 Change Management

This Handbook and the project safety plan address known activities and associated hazards. As work progresses, if significant changes are identified which could affect health, safety, or environmental conditions at the site, coordinate with the RHSM or EM to determine whether an update to the safety plan and/or environmental plan are necessary. Follow the change management protocol in the safety plan.

The following are examples of changes that may require a revision to the plan:

- Change in CH2M HILL staff;
- New subcontractor to perform work;
- New chemicals brought to site for use;
- Change in scope or addition of new tasks;
- Change in contaminants of concern (COCs) or change in concentrations of COCs; and
- New hazards or hazards not previously identified that are not addressed in this Handbook or the project safety plan.

5.4 Agency Inspection Guidance

(Reference CH2M HILL SOP HSE-201, Agency Inspections and Communications)

Agency inspections (e.g., OSHA, EPA, other regulatory agencies) are on the rise. CH2M HILL implements safety and environmental programs in order to ensure safety to workers, the public, and the environment. Field personnel need to contact the RHSM to update the project safety plan if hazards are encountered that are not addressed.

<u>SOP HSE-201</u> addresses agency inspections in detail. It is critical to make immediate notification to the RHSM if an inspector arrives (and EM if it is environmental-related); they can help facilitate and make additional notifications.

Review the Target Zero Bulletin attached to the project safety plan. Make it a topic at a safety meeting and keep it readily available in the event of an inspection.

6. Project Hazard Analysis

A health and safety risk analysis is performed for each task of a given project. In the order listed below, the RHSM considers the various methods for mitigating the hazards. Employees are trained on this hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects:

- Elimination of the hazards (use remote sampling methodology to avoid going into a confined space);
- Substitution (reduce exposure to vapors by using of a geoprobe instead of test pitting);
- Engineering controls (ventilate a confined space to improve air quality);
- Warnings (establish exclusion zones to keep untrained people away from hazardous waste work);
- Administrative controls (implement a work-rest schedule to reduce chance of heat stress); or
- Use of PPE (use of respirators when action levels are exceeded).

Employees are trained on the hierarchy of controls during their hazardous waste training and reminded of them throughout the execution of projects.

6.1 Hazard Identification and Control – The 10 Energies

Hazards are created when an object interacts with a type of energy or combination of energies. The first step in incident prevention is recognizing the energy source(s) and the potential for an uncontrolled release of, or contact with, that energy source. Identifying potential energy sources associated with a piece of equipment or a task allows us to mitigate the hazard correctly.

The 10 types of energy to consider are:

- Chemical
- Electrical
- Gravity
- Mechanical
- Motion
- Pressure
- Sound
- Radiation
- Temperature
- Biological



As described in the hierarchy of controls above, there are four basic options available to prevent unwanted exposure of the energy or energies:

- Eliminate the energy,
- Control the energy,
- Provide a protective barrier or,
- Use stop work authority

When possible, plan or do work that does not require exposure to an energy source. Take action to remove or control the energy source, or be sure that barriers are adequate to mitigate the resulting hazard (engineering controls, PPE, etc.). Use safe work observations to look for body position and placement and use of safety equipment with respect to energy sources present and the potential for an uncontrolled release or contact (line of fire incidents!).

Identify the energy source(s) in the safety plan and AHA or during the pre-task safety briefing and **verify** controls are in place for each task or STOP work until they are.

6.2 Activity Hazard Analysis

An AHA must be developed for each CH2M HILL field activity. The AHA shall define the work tasks required to perform each activity, along with potential HSE hazards and recommended control measures for each hazard, incorporating the hazardous energies described above. In addition, a listing of the equipment to be used to perform the activity, inspection requirements to be performed and training requirements for the safe operation of the equipment listed must be identified. Workers are briefed on the AHA before performing the work and their input is solicited prior, during, and after the performance of work to further identify the hazards posed and control measures required.

6.3 Subcontractor Activity Hazard Analysis

CH2M HILL subcontractors are required to provide AHAs specific to their scope of work on the project for acceptance by CH2M HILL. Each subcontractor shall submit AHAs for their field activities, as defined in their scope of work, along with their project safety plan and procedures. Additions or changes in field activities, equipment, tools, or material used to perform work or hazards not addressed in existing AHAs requires either a new AHA to be prepared or an existing AHA to be revised.

7. General Hazards and Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. It is a summarized list of requirements. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented.

7.1 Bloodborne Pathogens

(Reference CH2M HILL SOP HSE-202, Bloodborne Pathogens)

Exposure to bloodborne pathogens may occur when rendering first aid or cardiopulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material (PIM).

Employees trained in first-aid/CPR or those exposed to PIM must complete CH2M HILL's 1-hour bloodborne pathogens computer-based training module annually. When performing first-aid/CPR the following shall apply:

- Observe universal precautions to prevent contact with blood or other PIMs. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials;
- Always wash your hands and face with soap and running water after contacting PIMs. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes; and
- If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use one part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other PIMs. Remove contaminated PPE as soon as possible before leaving a work area.

CH2M HILL will provide exposed employees with a confidential medical examination should an exposure to PIM occur. This examination includes the following procedures:

- Documenting the exposure;
- Testing the exposed employee's and the source individual's blood (with consent); and
- Administering post-exposure prophylaxis.

7.2 Chemical Storage

The following is general guidance for storing chemicals and other hazardous materials:

- Keep acids away from bases;
- Keep oxidizers (nitric acid, nitrates, peroxides, chlorates) and organics away from inorganic reducing agents (metals);
- Keep flammables and corrosives in appropriate storage cabinets;
- Do not store paper or other combustibles near flammables;
- Use secondary containment and lipped shelving that is secured; and
- Have a fire suppression system available.

7.2.1 Storage of Flammable/Combustible Liquids

- Only approved containers and portable tanks shall be used for storage and handling of flammable and combustible liquids.
- Approved safety cans shall be used for the handling and use of flammable liquids in quantities of 5 gallons (19 liters) or less. Do not use plastic gas cans.

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- For quantities of 1 gallon (3.78 liters) or less, the original container may be used for storage and use of flammable liquids.
- Flammable or combustible liquids shall not be stored in areas used for stairways or normally used for the passage of people.

7.2.2 Indoor Storage of Flammable/Combustible Liquids

- No more than 25 gallons (95 liters) of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet.
- Quantities of flammable and combustible liquids in excess of 25 gallons (95 liters) shall be stored in an acceptable or approved cabinet.
- Cabinets shall be conspicuously lettered: "FLAMMABLE: KEEP FIRE AWAY."
- Not more than 60 gallons (228 liters) of flammable or 120 gallons (456 liters) of combustible liquids shall be stored in any one storage cabinet. Not more than three such cabinets may be located in a single storage area.

7.2.3 Outside Storage of Flammable/Combustible Liquids

- Storage of containers (not more than 60 gallons [228 liters] each) shall not exceed 1,100 gallons (4,180 liters) in any one area. No area shall be within 20 feet (6.1 meters) of any building.
- Storage areas shall be graded to divert spills away from buildings and surrounded by an earthen dike.
- Storage areas may not be located near a storm drain. Overflow and spills must be diverted away from storm drains or surface waters.
- Storage areas shall be free from weeds, debris, and other combustible materials.
- Outdoor portable tanks shall be provided with emergency vent devices and shall not be closer than 20 feet (6.1 meters) to any building.
- Signs indicating no smoking shall be posted around the storage area.

7.2.4 Storage of Hazardous Waste

- All facilities storing ignitable and combustible liquids and hazardous wastes must be designed, constructed, maintained, and operated to minimize the possibility of a fire, explosion, or any release of hazardous constituents.
- Flammable wastes should be stored more than 50 feet from the property line.

7.2.5 Storage of Chemical Injection Chemicals/Materials

- When chemical injection remediation technologies are being used at a site, the following storage guidelines must be followed:
- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use
 of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new
 Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security the applicability
 depends on the chemical, quantity/concentration, and type of facility. Please contact the project
 Environmental Manager to determine whether chemicals are subject to these standards.
- Injection chemicals must be stored in a designated, secured area with spill prevention capabilities. Review Safety Data Sheet (SDS) or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

7.3 Driving Safety

(Reference CH2M HILL HSE Policy 205, Distracted Driving – Wireless Devices, Vehicle Safety Core Standard)

All CH2M HILL employees are prohibited from using wireless devices while operating a motor vehicle when conducting company business regardless of the location or vehicle ownership and whether or not during regular working hours.

All CH2M HILL contractors and subcontractors are prohibited from using wireless devices while operating a CH2M HILL- or CH2M HILL client-owned, leased, or rented motor vehicle, or while operating any other Motor Vehicle on the project site.

Avoid distractions from wireless devices (e.g., mobile phones, smartphones, voice recognition systems, PDAs, notebook, tablets, or laptops) by turning off or silencing the wireless devices before operating a motor vehicle.

- Prohibited use includes the following:
 - Dialing or speed dialing
 - Using a hands-free or voice recognition (blue tooth) device to dial or speed dial
 - Engaging in conversation or listening to a conversation using a wireless device
 - Checking emails or surfing the internet using a wireless device
 - Texting or e-mailing (reading, sending, or screening) with a wireless device
 - Programming or entering coordinates into a global positioning system (GPS) device (following directions by a GPS is permitted)
 - Using a wireless device for voice recording or dictation
 - Employees, contractors, and subcontractors who need to use a wireless device must pull off the road to a safe location, with the vehicle securely stopped and emergency flashers on, or wait until they reach their destination.

Follow the guidance below when operating a vehicle:

- All vehicles have blind spots to the side and the rear. Follow these safe practices for backing up:
 - Walk around your vehicle prior to moving
 - Try to position your vehicle so that you don't have to back up
 - Back into the space if possible when you're parking
 - Back to the left, if possible, so that you can see objects on the driver's side
 - Have a spotter guide your vehicle when you're backing up
 - Apply GOAL (Get Out And Look)
- Obey speed limits; be aware of blind spots or other hazards associated with low visibility. Practice
 defensive driving techniques, such as leaving plenty of room between your vehicle and the one ahead of
 you;
- Do no drive while drowsy. Drowsiness can occur at any time, but is most likely after 18 hours or more without sleep;
- Maintain focus on driving. Eating, drinking, smoking, adjusting controls can divert attention from the road. Take the time to park and perform these tasks when parked rather than while driving; and

• Ensure vehicle drivers are familiar with the safe operation of vehicles of the type and size to be operated. Large vehicles such as full size vans and pick-ups have different vision challenges and handling characteristics than smaller vehicles.

7.4 Electrical Safety

(Reference CH2M HILL SOP HSE-206, Electrical Safety)

Below are the hazard controls and safe work practices to follow when using electrical tools, extension cords, and/or other electrical-powered equipment or when exposed to electrical hazards. Ensure the requirements of the referenced SOP are followed:

- Only qualified personnel are permitted to work on unprotected energized electrical systems;
- Only authorized personnel are permitted to enter high-voltage areas;
- CH2M HILL employees who might from time to time work in an environment influenced by the presence of electrical energy must complete Awareness Level Electrical Safety Training located on the CH2M HILL Virtual Office;
- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented;
- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment, remove from service;
- CH2M HILL has selected Ground Fault Circuit Interrupters (GFCIs) as the standard method for protecting employees from the hazards associated with electric shock;
 - GFCIs shall be used on all 120-volt, single phase 15 and 20-amphere receptacle outlets which are not part of the permanent wiring of the building or structure.
- An assured equipment grounding conductor program may be required under the following scenarios:
 - GFCIs cannot be utilized;
 - Client requires such a program to be implemented; or
 - Business group decides to implement program in addition to GFCI protection.
- Extension cords must be equipped with third-wire grounding. Cords passing through work areas must be covered, elevated or protected from damage. Cords should not be routed through doorways unless protected from pinching. Cords should not be fastened with staples, hung from nails, or suspended with wire;
- Electrical power tools and equipment must be effectively grounded or double-insulated and Underwriters Laboratory (UL) approved;
- Operate and maintain electric power tools and equipment according to manufacturers' instructions;
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage; and
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

7.5 Extended Work Hours and Fatigue Management

A normal work shift is considered to be eight consecutive hours during the day, five days a week, with at least an eight hour rest period. Any shift that incorporates more continuous hours, requires more consecutive days of work, or requires work during the evening should be considered extended or unusual.

Extended or unusual work shifts are typically more stressful for workers physically, mentally, and emotionally, and can lead to increased fatigue, stress, and lack of concentration. These effects can lead to an increased risk of worker error, incidents, and injuries.

If your field project requires extended work hours, including drive time, you must consult with your PM and HSM for approval of the extended hours/days and to be certain that fatigue management practices are included in your safety plan.

Fatigue shall be managed by using a risk management approach which includes:

- Identifying the contributing factors (work hours, type of work to be performed, time of day, travel fatigue/jet lag), collaborating with employees, reviewing incident trends;
- Assessing the risks associated with workplace conditions that contribute to fatigue including time of day, opportunities to recover, how many people are fatigued, skills and experience of those who experience fatigue; and
- Determining and implementing controls to prevent or minimize the risk and reviewing the effectiveness of the controls.

7.6 Field Ergonomics and Manual Lifting

(Reference CH2M HILL SOP HSE-112, Manual Lifting)

Some of the most common injuries during field work are the result of performing work in an awkward body position (poor ergonomics) or pushing the body beyond its natural limits. Workers who have to lift, stoop, kneel, twist, grip, stretch, reach overhead, or work in other awkward positions regularly are at risk of developing discomfort or even an injury. Additionally, back injuries are one of the leading causes of work disability and most back injuries are the result of improper lifting techniques or overexertion.

Contact the RHSM to determine hazard control measures if your task involves:

- Repetitive motions;
- Lifting and carrying items over long distances (100 feet) or on uneven, steep, or sloped terrain;
- Heavy lifting;
- Use of vibrating tools or equipment; or
- Being in a static position for extended periods of time;

There are a variety of ergonomically designed tools and work practices that can reduce the potential for discomfort and injury. Following are requirements ("must" or "shall") and recommendations ("should") to aid in the prevention of discomfort or injuries while working in the field.

Fitness for Duty

If manual lifting and repetitive activities are not part of your normal work duties, contact your PM and/or RHSM to help determine if you have the physical capability to perform the work. In many cases adding lifting or repetitive tasks to a subcontractor's scope of work is desirable to prevent injury. If the work task causes any pain or discomfort stop and get assistance.

Manual Lifting

- All CH2M HILL workers must have training in proper manual lifting either through New Employee Orientation or through the Manual Lifting module located on the VO;
- When possible, the <u>task</u> should be modified to minimize manual lifting hazards or awkward body positions;
- Lifting occasional loads weighing more than 40 pounds (18 kilograms) should be evaluated by the SC using the Lifting Evaluation Form contained in SOP HSE-112;
- When performing <u>repetitive</u> lifting tasks with loads over 40 pounds, the Lifting Evaluation Form contained in SOP HSE-112 shall be used, and mechanical means used where possible;
- Personnel shall seek assistance when performing manual lifting tasks that appear beyond their physical capabilities;
- Using mechanical lifting devices such as forklifts; cranes, hoists, and rigging; hand trucks; and trolleys; is the preferred means of lifting heavy objects;



- Lift and Work in the Power Zone The power zone for lifting or working is close to the body, between mid-thigh and mid-chest height. This zone is where arms and back can lift the most with the least amount of effort. This is zone is sometimes refered to as the "strike zone";
- Work near elbow height to avoid excessive bending (avoid working above the shoul Source: OSHA knees);
- Plan before carrying:
 - Wear appropriate shoes to avoid slips, trips or falls
 - If you wear gloves, wear gloves that fit. Tight-fitting gloves can put pressure on the hands, while loose-fitting gloves reduce grip strength and pose other safety hazards.
 - Avoid carrying large or bulky loads that limit or obstruct your vision
 - Slide, push, or roll instead of carrying when appropriate
 - When there is a choice, push instead of pull
 - Carry only as much as you can safely handle
 - Try to avoid slopes, stairs, or other obstacles that make carrying materials more difficult
 - Beware of and try to avoid slippery floors (e.g., liquids, ice, oil, and fine powders)
 - Use extra caution when moving loads that may be unstable
- In general, the following steps must be practiced when planning and performing manual lifts:
 - Examine the load and the surrounding area
 - Bend knees when lifting a load
 - Look forward to keep back straight
 - Position the load close to the body
 - Maintain a firm grip on the load
 - Test the load for stability and weight prior to lifting
 - Use smooth, controlled movements
 - Keep arms in front of body
 - Turn feet in direction of movement to avoid twisting
- Avoid carrying objects more than 100 feet;

Ergonomic Work Practices

• Avoid repetitive motions, overhead reaching, and kneeling when possible;

- If prolonged awkward postures are unavoidable, use a "supported" posture to compensate; a supported posture uses part of your body to support the weight of another body segment that is in an awkward position;
- Watch your pace—attempting to do something faster can cause you to lose proper form;
- Use a table or move work to a location where you don't have to be in a bent-over position to do your work; and
- Where awkward postures or repetitive motions are unavoidable, rotate with another worker, change tasks, stretch, and take short breaks frequently.

7.7 Field Trailer/Office Setup and Maintenance

- Determine trailer placement by considering all potential hazards that could impact "office" work. Trailers usually are placed in the support zone and out of construction zones. Think about what type of PPE will be necessary when exiting the trailer, parking needs, biological hazards or other hazards that could impact location.
- Check utility configuration prior to placement, including electrical, water, and sewer.
- Use spotters when placing trailer.
- Set on flat ground.
- Be sure trailer wheels are chocked.
- When disconnecting trailer from hitch—watch pinch points and wear leather gloves.
- Carefully jack trailer using the appropriately rated jacks and following manufacturer's recommendations.
- Secure and anchor trailer to protect from wind or other severe weather.
- Place cones in front of hitch.
- Ensure proper stairs and secure stairs next to doors. Ensure stairs are "no slip" and that the platform or landing of the stairs is flush the door threshold.
- Use only qualified electricians to establish electrical service.
- Consider ergonomics when furnishing trailer with desks and chairs.
- Place fire extinguishers near doors, and place signage.
- Put up emergency contacts, evacuation and rally point map, and route to the hospital
- Place right to know posters (OSHA required information).
- Place signage on exit doors.
- Never place porta-johns at HVAC intake (usually HVAC is located at the front of trailer).
- Have capability to properly store food—temporary field offices can quickly develop rodent issues if food is not stored properly or the trailer isn't cleaned regularly.

7.8 Field Vehicles

- Field vehicles may be personal vehicles, rental vehicles, fleet vehicles, or project vehicles.
- Maintain a first aid kit and bloodborne pathogen kit in the field vehicle.
- Assess whether maintaining a fire extinguisher in the field vehicle is feasible. If fire extinguishers are readily available, for example on heavy equipment, or if the project is short duration, a fire extinguisher would not

be necessary. Fire extinguishers in field vehicles need to be properly secured and inspected on a monthly basis.

- The following precautions should be implemented if work involves stopping or parking along roadways:
 - Freeways and limited access no stopping/parking allowed
 - Roads with speed limits 50 mph or higher flashing beacon required on top of the vehicle.
 - Roads with speed limits 35 mph or higher with no/limited shoulder (not able to get fully off the road at least 12 inches from the fog line or road edge) - flashing beacon required
 - Roads with speed limits 35 mph or higher with full shoulder (are able to get fully off the road at least 12 inches from the fog line or road edge) flashers required
 - Roads with speed limits under 35 mph flashers required
- Familiarize yourself with rental vehicle features prior to operating the vehicle:
 - Vision Fields and Blind Spots
 - Vehicle Size
 - Mirror adjustments
 - Seat adjustments
 - Cruise control features, if offered
 - Pre-program radio stations and Global Positioning System (GPS), if equipped
- Always wear seatbelt while operating vehicle.
- Adjust headrest to proper position.
- Tie down loose items if utilizing a van or pick-up truck.
- Close car doors slowly and carefully. Fingers can get pinched in doors.
- Park vehicle in a location where it can be accessed easily in the event of an emergency. If not possible, carry a phone.
- Have a designated place for storing the field vehicle keys when not in use.
- Ensure back-up alarms are functioning, if equipped. Before backing a vehicle, take a walk around the vehicle to identify obstructions or hazards. Use a spotter when necessary to back into or out of an area.
- See the Vehicle Incident Guidance attached to the project safety plan, if a vehicle incident is experienced in a rental or fleet vehicle.

7.9 Fire Prevention

(Reference CH2M HILL SOP HSE-403, Hazardous Material Handling)

Follow the fire prevention and control procedures listed below.

7.9.1 Fire Extinguishers and General Fire Prevention Practices

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet (30.5 meters). When 5 gallons (19 liters) or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet (15.2 meters). Extinguishers must:
 - be maintained in a fully charged and operable condition;
 - be visually inspected each month; and
 - undergo a maintenance check each year.

- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 feet (3 meters) from any building.
- Solvent waste and oily rags must be kept in a fire resistant, covered container until removed from the site.
- Keep areas neat. Housekeeping is important.

7.9.2 Dispensing of Flammable/Combustible Liquids

- Areas in which flammable or combustible liquids are dispensed in quantities greater than 5 gallons (22.7 liters) (shall be separated from other operations by at least 25 feet (7.6 meters).
- Drainage away from storm drains or surface waters or other means of containment shall be provided to control spills.
- Adequate natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10 percent of the lower flammable limit.
- Dispensing of flammable liquids from one container to another shall be done only when containers are electrically interconnected (bonded).
- Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks is prohibited.
- Dispensing devices and nozzles for flammable liquids shall be of an approved type.

7.10 General Practices and Housekeeping

The following are general requirements applicable to all portions of the work:

- Site work should be performed during daylight hours whenever possible;
- Good housekeeping must be maintained at all times in all project work areas;
- Common paths of travel should be established and kept free from the accumulation of materials;
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions;
- Provide slip-resistant surfaces, ropes, or other devices to be used;
- Specific areas should be designated for the proper storage of materials;
- Tools, equipment, materials, and supplies shall be stored in an orderly manner;
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area;
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals;
- All spills shall be quickly cleaned up; oil and grease shall be cleaned from walking and working surfaces;
- Review the safety requirements of each job you are assigned to with your supervisor. You are not expected to perform a job that may result in injury or illness to yourself or to others;
- Familiarize yourself with, understand, and follow jobsite emergency procedures;
- Do not fight or horseplay while conducting the firm's business;
- Do not use or possess firearms or other weapons while conducting the firm's business;
- Report unsafe conditions or unsafe acts to your supervisor immediately;

- Report emergencies, occupational illnesses, injuries, motor vehicle incidents, and near misses immediately;
- Do not remove or make ineffective safeguards or safety devices attached to any piece of equipment;
- Report unsafe equipment, defective or frayed electrical cords, and unguarded machinery to your supervisor;
- Shut down and lock out machinery and equipment before cleaning, adjustment, or repair. Do not lubricate or repair moving parts of machinery while the parts are in motion;
- Do not run in the workplace;
- When ascending or descending stairways, use the handrail and take one step at a time;
- Do not apply compressed air to any person or clothing;
- Do not wear steel taps or shoes with metal exposed to the sole at any CH2M HILL project location;
- Do not wear finger rings, loose clothing, wristwatches, and other loose accessories when within arm's reach of moving machinery;
- Remove waste and debris from the workplace and dispose of in accordance with federal, state, and local regulations;
- Note the correct way to lift heavy objects (secure footing, firm grip, straight back, lift with legs), and get help if needed. Use mechanical lifting devices whenever possible; and
- Check the work area to determine what problems or hazards may exist.

7.11 Hazard Communication

(Reference CH2M HILL SOPs HSE-107, Hazard Communication and HSE-403, Hazardous Material Handling)

The hazard communication coordinator is to perform the following:

- Complete an inventory of chemicals brought on site by CH2M HILL using the chemical inventory form included as an attachment to the project safety plan;
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available;
- Request or confirm locations of safety data sheets (SDSs) from the client, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed;
- Before or as the chemicals arrive on site, obtain an SDS for each hazardous chemical and include on the chemical inventory sheet (attached to the project safety plan) and add the SDS to the SDS onsite notebook;
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly;
- Give employees required chemical-specific HAZCOM training using the chemical-specific training form included as an attachment to the project safety plan; and
- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

7.12 Knife Use

Open-bladed knives (for example, box cutters, utility knives, pocket knives, machetes, and multi-purpose tools with fixed blades such as a Leatherman[™]) are prohibited at worksites except where the following three conditions are met:

• The open-bladed knife is determined to be the best tool for the job;

- An approved Activity Hazard Analysis (AHA) or written procedure is in place that covers the necessary safety precautions (work practices, PPE, and training); and
- Knife users have been trained and follow the AHA.

Specific precautions for knife use include:

- Employees are responsible for using cutting tools in the way they are intended, maintaining them in good working order and reporting faulty or unusable items. PPE as specified in the AHA is to be used;
- Those engaging and supervising subcontractors are to ensure that the requirements of this policy are communicated;
- The most appropriate gloves shall be identified within the AHA. In general, cut resistant gloves (e.g., Kevlar) are to be worn when using a knife in an occupational setting. Other types of gloves may be required and will be identified within the AHA. An example may be leather gloves may be worn when using the acetate sleeve cutter;
- All employees that will use a cutting tool must be trained in the proper use;
- Position the item to be cut on a stable surface. Secure it to prevent slippage, wherever possible. Select a work location which does not put your body in the line of fire of a knife slippage or failure;
- When using a knife do not cut towards yourself;
- When cutting, make the force of the cut carry the blade away from any part of your body. If you have a situation where this is not possible, protect yourself with a leather apron, or other material placed between you and the blade. Consider putting the material to be cut in a vise, or other holding device;
- Many tasks using a utility knife require a knife edge but not a sharp point. For these tasks you can add protection against puncture wounds by using a rounded-tip blade;
- In general, a pocket knife if not the preferred tool of choice as there are alternatives (e.g., retracting safety blade).
- If you use a folding knife, it must be a locking blade type.
- Never use a knife that will fold under pressure.
- If you use a fixed blade knife, make sure there is a handle guard to keep your hand from slipping forward. Also, make sure the handle is dry and non- greasy/slippery to assure a better grip. If you carry a fixed blade knife, use a sheath or holder.
- Store utility knives safely, retract the blade or sheath an open blade before storing. Never, leave a knife with the blade exposed on the floor, on a pallet, on a work surface, or in a drawer or cabinet.
- Keep your knife sharp. A dull blade requires you to use more force to cut, and consequently increases the risk of slip or mistake.
- Knives used on the job, but not carried with you, must be properly stored when not in use;
- Never use a defective knife;
- Utility knife blades are brittle and can snap easily. Don't bend them or apply side loads to them by using them to open cans or pry loose objects. Use the knife only to cut. It was not designed to work as a pry bar, screwdriver, or hole punch.

7.13 Lighting

Lighting shall be evaluated when conducting work inside buildings, confined spaces, or other areas/instances where supplemental light may be needed (e.g., work before sunrise or after sunset). A light meter can be used to evaluate

the adequacy of lighting. The following are common requirements for lighting and the conditions/type of work being performed:

- While work is in progress outside construction areas shall have at least 33 lux (lx);
- Construction work conducted inside buildings should be provided with at least 55 lux light;
- The means of egress shall be illuminated with emergency and non-emergency lighting to provide a minimum 11 lx measured at the floor. Egress illumination shall be arranged so that the failure of any single lighting unit, including the burning out of an electric bulb will not leave any area in total darkness.

7.14 Personal Hygiene

Good hygiene is essential for personal health and to reduce the potential of cross-contamination when working on a hazardous waste site. Implement the following:

- Keep hands away from nose, mouth, and eyes during work;
- Keep areas of broken skin (chapped, burned, etc.) covered; and
- Wash hands with soap and water prior to eating, smoking, or applying cosmetics.

7.15 Personal Security

Follow the guidelines below for personal security measures. The RHSM and Firm-Wide Security Office can be contacted if additional, specific measures are needed (e.g., such as evaluating the needs for security service).

General Safety and Security Guidelines

CH2M HILL Corporate Security Department recommends the following guidelines for workers in the United States:

- Stay alert and be aware of your surroundings. Avoid pre-occupations with mobile devices, while in an unfamiliar area.
- Whenever possible use the buddy system with another employee or client or subcontractor employee.
- Trust your intuition; if a situation appears strange or wrong, it probably is.
- Be confident in your walk or stride; do not give the appearance you are new in town.
- Avoid carrying and displaying large sums of cash.
- If you sense or see dangerous situations along your route, change your route and depart the area quickly. If you feel that you are being followed, go to the nearest police station or safe location and file a complaint with the police. Provide a description of the person, their vehicle, license plate number and any other useful information.
- Only walk short distances that are safe and secure while visiting an unfamiliar city or location.
- Take host approved transportation for long distances.
- "Fight or Flight?" Leaving the possible or dangerous area is always better than staying to fight.
- Always report suspicious activity to the nearest local law enforcement agency.
- Locate emergency exits in your hotel or where you are staying to ensure you know where to go in case of a fire or a natural or man-made disaster.
- Secure your electronic devices when left in your room or take them with you if you are not able to secure them properly.
- If you feel your life is in danger, call 911. Be sure to speak clearly, concisely and give the dispatcher a good description of where you are physically located.

Operating or Riding in Vehicles

- When waiting for public transportation or a taxi, remain in a store or restaurant as long as possible before catching your ride and never wait by yourself in an isolated area.
- Approach your vehicle with keys firmly in your hand and ready to unlock the car.
- Quickly check your car before entering it to determine damage or presence of an intruder.
- Vulnerable times can be stopping to find your keys to enter your vehicle or stepping out of your vehicle in an isolated area. Be aware of your surroundings before you perform these activities.
- Always keep your doors locked during transit and when the vehicle is parked.
- Never leave your vehicle unlocked, even when to performing a quick task such as checking in a hotel, getting gas or going picking up food.
- If confronted by an individual inside a vehicle pointing a weapon at you, run the opposite way from where the vehicle is facing and scream as loud as you can. This evasive action will probably cause the individual to drive away.
- If an individual in a passing car points at your tires or engine to indicate a malfunction, only pull over in a well-lit and populated gas or rest stop. Never pull over in an isolated or dimly lit area. You may have a malfunction or the passing motorist may be attempting to rob you.
- Always park your vehicle is a well-lit and secure area. If your vehicle is parked in a dimly lit or isolated area in a parking garage; ask an attendant or friend to accompany you to your vehicle.
- Secure your valuables in the trunk, or place them out of sight or cover them with a blanket or coat if there is no secure storage area in the vehicle. The would-be-perpetrator likes to see what to steal and not knowing what you have concealed will normally prevent a break in.

Riding in a Taxi

- Have your host or a designated travel agent suggest or reserve a reputable taxi service for you during your stay.
- Only use a taxi service that was vetted for safety and reliability.
- If possible, place luggage, laptop and personal belongings inside the taxi.
- When you first enter the taxi, check the driver photo identification card, normally located on the driver's visor with the driver to ensure they match.

Walking

- If you experience automotive trouble, remain inside the locked vehicle and call for assistance.
- If you can't reach assistance via a mobile phone, only walk for help in a safe area facing the traffic.
- If while walking, you are shadowed or followed by a vehicle, run back in the direction of your vehicle and enter the vehicle if possible. File a police report on the incident as soon as practicable.
- Be aware of your surroundings and those around you while walking and do not be distracted by using electronic devices.
- Regularly change your route if you are walking to and from meetings or conferences and choose only welllit areas to walk in at night.
- If walking long distances, identify a "safe house, shop, store or restaurant" to duck into if confronted by a perpetrator.

Jogging or Running

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- Always jog or run in an area that is safe, secure, and used for exercising.
- Avoid running along busy roads or highways.
- If you chose to venture out on a jog or run, check the route by vehicle prior to beginning to exercise.
- Let the host or a friend know when you leave, when you plan to return, and the route you will take during exercising.
- Take a photo identification and mobile phone with you for emergencies.
- Avoid physically over-extending yourself since reflexes and decision-making ability can be impaired.

Clothing and Jewelry

- Dress to blend in with locals, maintain a low profile and avoid drawing attention to yourself.
- Travel with inexpensive clothing and jewelry.
- Avoid wearing CH2M HILL distinctive clothing or using CH2M HILL logos on luggage or laptops.

Emergency Numbers and Information

- Leave your itinerary and emergency contact numbers where you can be reached with family members and only those that have a need to know.
- Pre-program emergency numbers in the mobile device you are traveling with.
- Carry a list of current medications and specific doses in your purse or wallet.
- Record medical emergency information on a document that can be readily available if you are unable to speak or unconscious.
- Have a photo copy of your driver's license, passport, and credit card information separately in case your wallet or purse is stolen.

7.16 Shipping and Transportation of Hazardous Materials

(Reference CH2M HILL SOP HSE-417, Hazardous Materials Transportation)

The U.S. Department of Transportation (DOT) has specific regulations governing shipping of hazardous materials (also called dangerous goods) including calibration gases used in personal exposure monitoring or field instruments. Chemicals brought to the site might be defined as hazardous materials by the U.S DOT. Hazardous wastes that may be shipped offsite are also defined as hazardous materials by U.S. DOT. Other wastes may also be U.S. DOT hazardous materials. To confirm whether a material or a waste is a U.S. DOT hazardous material, check with the E&NBG Waste Coordinator (Lisa Schwan/ATL), the project EM, or the CH2M HILL Dangerous Goods Shipping Coordinators (John Blasco/BAO or Rob Strehlow/MKW).

All staff who affect shipment of hazardous materials, including receiving hazardous materials, preparing profiles or manifests, packaging hazardous wastes, labeling, or transporting hazardous materials by road, are called HazMat employees (note CH2M HILL cannot transport hazardous wastes by public road). HazMat employees must receive CH2M HILL online training in shipping dangerous goods. CH2M HILL's online Dangerous Goods Shipping course can be found on the CH2M HILL HSE website.

All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. If the material is a product that is being shipped (e.g., calibration gas), use the HazMat ShipRight tool on the CH2M HILL virtual office (under Company Resources – Online Shipping). Contact the Dangerous Goods Shipping coordinators, the E&NBG Waste Coordinator or the project EM for additional information.

49 CFR 172 requires that all hazmat employees be aware of potential transportation security concerns. Hazardous materials security is addressed in CH2M HILL's Hazardous Materials SOP (HSE-403). The following points are provided as an overview of security measures to increase awareness of this important matter:

- It is essential that each employee understand the security risks involved with transporting hazardous materials;
- All transporters of hazardous materials must be prequalified by a Contracts Administrator who evaluate the carrier's safety rating, security measures, and employee screening procedures;
- When shipping hazardous materials, check driver credentials and ask about shipping details;
- When receiving a hazardous materials shipment, inspect packages for signs of tampering or damage to the contents. Verify the drivers and company information on the form with the driver; and
- If there is suspicious or unusual behavior (e.g., driver without credentials, evasive answers) or any discrepancies identified, do not offer or accept the shipment, and immediately notify the project manager or the RHSM.

Employees responsible for shipping hazard materials must also review the CH2M HILL Transportation Security Plan (HSE-417 Appendix A).

7.17 Substance Abuse

(Reference CH2M HILL Policy 810, Drugfree Workplace)

Employees who work under the influence of controlled substances, drugs, or alcohol may prove to be dangerous or otherwise harmful to themselves, other employees, clients, the company, the company's assets and interests, or the public. CH2M HILL does not tolerate illegal drug use, or any use of drugs, controlled substances, or alcohol that impairs an employee's work performance or behavior.

Prohibitions onsite include:

- Use or possession of intoxicating beverages while performing CH2M HILL work;
- Abuse of prescription or nonprescription drugs;
- Use or possession of illegal drugs or drugs obtained illegally;
- Sale, purchase, or transfer of legal, illegal or illegally obtained drugs; and
- Arrival at work under the influence of legal or illegal drugs or alcohol.

Drug and/or alcohol testing is applicable under Policy 810. In addition, employees may be required to submit to drug and/or alcohol testing as required by clients. This testing is performed in accordance with Policy 810, Drug-Free Workplace. Contact the Drugfree Workplace administrator, Mary Beth Thomas/DEN (Federal Sector) or Brenda LaBonte/SPB (Commercial Sector), if testing is necessary.

7.18 Unknown or Suspect Objects/Materials

If unknown or suspect objects/materials are encountered (i.e., exposed or partially buried drums, biological waste, cylinders, glass containers, munitions of explosive concern, unexpected stained/discolored soil) are encountered during site operations, ongoing activities shall be immediately suspended. CH2M HILL or subcontractor personnel encountering unknown or suspect objects or materials shall:

- Secure the area and identify the location of the object/material to the extent possible, without causing bodily injury to yourself or others and without disturbing the object.
- Evacuate the work area.
- Immediately notify the project manager/RHSM of the encountered condition.

• Do not further disturb or otherwise handle the suspect object or material.

The site supervisor or SC shall contact the Project Manager and the RHSM to evaluate potential hazards associated with the specific situation encountered. The project team will then address the need for the use of special procedures, engineering controls, PPE or specialized subcontract personnel to safely mitigate the situation.

8. Project-Specific Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the work or the particular hazard. Each person onsite is required to abide by the hazard controls. Always consult the appropriate CH2M HILL SOP to ensure all requirements are implemented. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the RHSM for clarification.

8.1 Abrasive Blasting

(Reference CH2M HILL SOP HSE-122, Abrasive Blasting)

Abrasive blasting is the cleaning or preparing of a surface by forcibly propelling a stream of abrasive material against the surface using sand, glass bead, aluminum oxide, grit, garnet, steel shot, slag, walnut shells, and others. Below are the hazard controls and safe work practices to follow when overseeing or performing abrasive blasting.

- CH2M HILL employees who work on projects with abrasive blasting operations are required to complete the CH2M HILL 10-Hour Construction Safety Awareness training and waste management training.
- Abrasives and the surface coatings on the materials blasted are shattered and pulverized during blasting operations and the dust formed will contain particles of respirable size. The composition and toxicity of the dust from these sources shall be considered in making an evaluation of the potential health hazards. Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists.
- Personnel shall remain a safe distance from the abrasive blasting area to reduce exposure to hazardous airborne contaminants.
- Abrasive blasting equipment shall be inspected each day, before use, to ensure safe operational condition.
- Non-silica containing abrasive blasting materials must be used to the extent possible.
- Blast nozzles must be equipped with an operating valve that must be held open manually.
- Eating, drinking, and smoking shall be prohibited in areas where blasting is performed. Employees shall wash their face and hands before eating, drinking or smoking.
- Abrasive blasting debris shall be cleaned up by using dust-free methods. Wet clean-up methods and vacuum cleaners with High Efficiency Particulate Air (HEPA) filters are recommended.
- Fugitive dust must be controlled during abrasive blasting operations by using water sprays or other methods.
- Noise must be monitored and controlled as required by state or local regulations.
- Complete the abrasive blasting self-assessment checklist when performing or when subcontractors perform this operation.

8.2 Aerial Lifts

(Reference CH2M HILL, SOP HSE-301, Aerial Lifts)

Below are the hazard controls and safe work practices to follow when working around or operating aerial lifts. Ensure the requirements in the referenced SOP are followed:

- Operate aerial lifts only if you are authorized and trained to do so;
- Inspect aerial lifts and test lift controls prior to use;

- Wear a full-body harness, with a lanyard attached to the boom or platform (see also SOP HSE-308, *Fall Protection*). When working within a standard guardrail system with scissors lifts, the full-body harness and lanyard are not required;
- Do not attach lanyard to any adjacent structures or equipment while working from an aerial lift;
- Stand firmly on the floor of the platform and do not sit or climb on the railings of the platform, or use planks, ladders, or other devices to increase working height;
- Remain on the platform at all times and do not leave the platform to climb to adjacent structures;
- Position aerial lifts on firm, level surfaces when possible, with the brakes set. Use wheel chocks on inclines. If outriggers are provided, position them on solid surfaces or cribbing;
- Maintain safe clearance distances between overhead power lines and any part of the aerial lift or conducting material, unless the power lines have been de-energized and grounded, or insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet (3 meters) from overhead power lines for voltages of 50 kilovolts (kV) or less, and 10 feet (3 meters) plus 0.4 inches (1.0 cm) for every 1 kV over 50 kV;
- Do not exceed the boom and basket load limits;
- Do not use aerial lifts as cranes, unless specifically designed and approved by the lift manufacturer;
- Do not work or stand below aerial lift operations;
- Do not use aerial lifts when winds exceed 30 miles per hour (48 km per hour) or per manufacturers recommendations; and
- Complete the self-assessment checklist for aerial lifts whenever aerial lifts are being used.

8.3 All-Terrain Vehicles and Utility-Type Vehicle Safety

An all-terrain vehicle (ATV) means any recreational vehicle with three or more tires, has handlebar steering, and a seat designed to be straddled by the operator and are not intended for use on paved roads.

Utility-type vehicle (UTV) means any recreational motor vehicle other than an ATV, motorbike, or snowmobile designed for and capable of travel over designated roads, traveling on four (4) or more tires.

ATVs/UTVs shall not be operated on site unless determined to be the most appropriate vehicle(s) to use and their use is pre-approved by the PM and RHSM.

Operators shall be trained and qualified before operation of the ATV or UTV onsite and will possess a valid driver's license.

ATV/UTV operators are prohibited from using any wireless device while operating ATVs/UTVs. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.

Training shall consist of manufacturer's operating manual, hands-on training by a competent person, a demonstration of basic skills, and when required by the state, completion of an ATV safety course. An AHA shall also be developed for the use of ATVs/UTVs and operators shall be trained on the AHA. All individuals are required meet all training aspects before ATV/UTV use and documentation of training shall be maintained at the site.

Some states listed below as requiring an ATV license actually require an ATV or even a motorcycle endorsement on the operator's current driver's license. Be sure to contact the local division of motor vehicles (DMV) office for details. The following are states that require a specialized driver's license: Arizona, Oregon, Georgia, and Illinois. New Hampshire's and Montana's requirements vary by city. Check your state for new local requirements.

Keep in mind, that states not mentioned above may still:

- Impose age restrictions for operating ATVs;
- Require an ATV safety or education course certification (even if you're older than 18);
- Require ATV insurance.

Daily inspections of vehicles for safety and maintenance are required.

Minimum PPE required for operators and passengers on ATVs include:

- Safety glasses, goggles, or face-shield at all times when moving;
- Leather boots or shoes (if safety-toed boots are not required by the project safety plan); and
- A properly fitted DOT/ANSI/SNELL-approved helmet.

Other safety requirements include:

- ATVs with fewer than four wheels are not allowed on site;
- ATVs and UTVs shall be operated in accordance with the manufacturer's operating manual, any state or client requirements, and task-specific AHA;
- Speed is not to exceed 20 mph. Keep all parts of your body inside any roll over protection;
- Always use the seat belt on UTVs;
- Make sure the engine is turned off before dismounting the vehicle;
- Avoid driving over any extremely large obstacles (i.e., wood/logs, fences, boulders, etc);
- When using trailers, watch your turning radius;
- Shut engine down prior to refueling;
- ATVs/UTVs must have fenders;
- Utilize high visibility flag and wear high visibility vest when operating adjacent to heavy equipment or haul vehicles.

8.4 Arsenic

(Reference CH2M HILL, SOP HSE-501, Arsenic)

Arsenic is considered a "Confirmed Human Carcinogen." CH2M HILL is required to control employee exposure to arsenic when exposures are at or above 5.0 micrograms per cubic meter (μ g/m³), or if there is the possibility of skin or eye irritation from arsenic. The elements of the CH2M HILL arsenic program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical surveillance;
- Training on hazards of arsenic and control measures (includes project-specific training and the computerbased training on CH2M HILL's Virtual Office, *Arsenic Exposure*); and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Full implementation of SOP HSE-501, Arsenic, will be required. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Avoid skin and eye contact with liquid and particulate arsenic or arsenic trichloride;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.5 Asbestos

(Reference CH2M HILL SOP HSE-502, Asbestos)

Asbestos is a cancer-causing mineral that was included in many building materials. When disturbed harmful asbestos fibers can be released and inhaled and ingested by workers. Materials suspected of containing asbestos shall be treated as asbestos unless documentation and testing results indicate otherwise. Where the presence of asbestos is suspected, if at all possible, design all operations to avoid contact.

When there is a risk of disturbing asbestos and making it friable (able to release fibers when the materials are crushed, abraded or cut) the activity becomes regulated. The asbestos standard for construction regulates asbestos exposure for the following activities:

- Demolishing or salvaging structures where asbestos is present in concentrations greater than 1 percent;
- Removing or encapsulating asbestos-containing materials (1 percent or greater asbestos content);
- Constructing, altering, repairing, maintaining, or renovating asbestos-containing structures or substrates;
- Installing asbestos containing products;
- Cleaning up asbestos spills/emergencies; and
- Transporting, disposing, storing, containing and housekeeping involving asbestos or asbestos containing products on a construction site.

CH2M HILL is required to control employee exposure to asbestos when exposures are at or above 0.1 fibers per cc (f/cc) by implementing a program that meets the requirements of the OSHA Asbestos standard, 29 Code of Federal Regulations (CFR) 1926.1101. The elements of the CH2M HILL asbestos program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical Surveillance;
- Training on hazards of asbestos and control measures; and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;

- Avoid skin and eye contact asbestos;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Review the fact sheet included as an attachment to the SOP; and
- Do not disturb waste or other materials labeled "Danger Asbestos Fibers."

Subcontractors performing asbestos abatement activities are required to obtain state or special licenses and permits and have a written compliance/abatement plan that has been reviewed and accepted by CH2M HILL before work begins. Subcontractors are required to provide proof that all asbestos workers medically qualified, training and a competent person has been appointed before work begins.

8.6 Benzene

(Reference CH2M HILL SOP HSE-503, Benzene)

Benzene is considered a "Confirmed Human Carcinogen." CH2M HILL is required to control employee workplace exposure to benzene when personal exposures is at or above 0.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the OSHA Benzene standard, 29 CFR 1910.1028. The elements of the CH2M HILL benzene program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of benzene and control measures (includes project-specific training and the computerbased training on CH2M HILL's Virtual Office, *Benzene*); and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.7 Cadmium

(Reference CH2M HILL SOP HSE-504, Cadmium)

Cadmium is considered a "Suspected Human Carcinogen." CH2M HILL is required to control employee workplace exposure to cadmium when personal exposure is at or above 2.5 micrograms per cubic meter (μ g/m³) by implementing a program that meets the requirements of the OSHA Cadmium standard, 29 *Code of Federal Regulations* (CFR) 1926.1127. The elements of the CH2M HILL cadmium program include the following:

- Exposure monitoring;
- Methods of control, including PPE and respirators;
- Medical surveillance;

- Training on hazards of cadmium and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Cadmium*); and
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.8 Chainsaws

(Reference CH2M HILL SOP HSE-210, Hand and Power Tools)

Below are the hazard controls and safe work practices to follow when working around or operating chainsaws. Ensure the requirements in the referenced SOP are followed.

8.8.1 Equipment

Only chainsaws equipped with a spark arrestor and fully functioning chain brake or "safety chain" shall be used. The following safety equipment shall be readily available while operating a chainsaw:

- Chainsaw operator's manual;
- Fully stocked first aid kit;
- Multipurpose fire extinguisher;
- Grounded extension cord approved for outdoor use and ground fault circuit interrupter (GFCI) for electrical-powered chainsaws;
- Approved safety gasoline container and funnel or flexible nozzle for refueling gasoline-powered chainsaws; and
- Sledge hammer and non-metallic wedges when necessary to prevent pinching of the chain.

8.8.2 PPE Requirements

The following personal protective equipment shall be worn while operating chainsaws:

- Safety glasses with side shields and face shield to prevent injury from wood chips, sawdust, or other flying objects;
- Hard hat with properly fitted suspension to prevent head injury from falling debris;
- Steel-toed safety shoes or boots to prevent foot injury from falling objects and accidental contact with the moving chain;
- Hearing protection to prevent permanent damage to hearing. Ear muffs or plugs will have a decibel noise reduction rating (NRR) assigned to them. The higher the rating, the greater the protection offered;
- Non-leather, fabric work gloves to prevent hand injury from abrasions, splinters and cuts;
- Clothing that is well-fitted and free of loose edges that could become entangled in the saw; and

• Protective chaps or leggings that cover the area from the groin to about 2 inches (5.08 cm) above the ankles should be used. These chaps are made from synthetic fabrics that are designed to prevent the running saw chain from coming in contact with your legs.

8.8.3 Safe Operation

The following safe operation guidelines shall be followed regardless of the purpose for using a chainsaw:

- Inspect the chainsaw prior to use;
- Chainsaws shall be held firmly with both hands, with thumbs and fingers encircling both chain saw handles;
- Stand slightly to the left side of the saw, out of the plane of the cutting chain and guide bar to reduce the risk of injury in the event of a kickback;
- Position saw so that it is between the waist and mid-chest level. Overreaching or cutting above the midchest height shall be avoided;
- Maintain a full throttle setting while cutting. Chainsaws are designed to be run at full speed;
- Always be aware of what is in the saw's downward path after the cut;
- Do not attempt to cut material that is larger than the guide bar of the saw;
- Avoid cuts that will cause the chainsaw to jam. Always cut into the compression wood first until the cut starts to close; then cut from the other side toward the compression cut;
- Use a non-metallic wedge to prevent the compression cut jamming on the blade;
- Chainsaws are designed to feed themselves into the wood and require only light pressure to cut efficiently. If extra force is required to keep cutting, the chain requires sharpening. Additional signs of a dull chain include a saw that is cutting crooked, results in fine sawdust instead of chips, or the smell of burnt wood. Do not use a dull chain;
- Bystanders and helpers shall be kept at a safe distance from operation;
- Do not operate a chainsaw when fatigued; take frequent breaks;
- Work slowly; don't rush; and
- A fire extinguisher shall be present at all times when operating the chainsaw in forest or brushy areas.

8.8.4 Refueling the Engine

The fuel for gasoline-powered chainsaws shall be mixed in accordance with the manufacturer's recommendations as outlined in the chainsaw operator's manual. Fuel shall be stored and transported in an approved safety container. The following precautions should also be followed:

- The engine shall be shut off and allowed to cool before refueling; never refuel a hot engine;
- A fire extinguisher shall be present during fueling and refueling;
- Smoking around fueling or refueling operations shall be prohibited; and
- A funnel or a flexible nozzle shall be used to avoid spilling fuel on the engine.

8.9 Chemical Injections

When the remedial action objectives for a project include subsurface injection of chemicals, the procedures and handling practices identified below must be implemented.

Pre-Injection

Review the Safety Data Sheets (SDSs) for the materials which are expected to be utilized in the chemical injection processes for this contract task order and:

- Document training in accordance with the Hazard Communication section of this Handbook.
- Ensure that appropriate spill response materials are present (e.g., absorbent media for oil, neutralizing agents for potassium permanganate, secondary containment for larger chemical tanks).

Evaluate potential for "daylighting" of chemical injection in the work area:

- Evaluation should identify known or potential pathways such as existing monitoring wells screened at the same depth interval as the planned injection, wells that were not properly abandoned, and utility corridors.
- Identify potential surface release areas such as nearby sensitive areas (e.g., wetlands) storm drains, ditches, or streams, and ensure that mitigation measures are in place (e.g., temporarily blocking storm sewer drains).
- Contact the project Environmental Manager for assistance in identifying release scenarios and mitigation measures.

Injection Operations

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and associated piping or hoses of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.
- For PPE and air monitoring requirements, refer to the PPE section and Site Monitoring section of the project safety plan. PPE shall be used to minimize potential exposure to identified site contaminants of concern and injection solutions during site injection operations. In addition, good personal hygiene practices and procedures must be practiced.
- Use face shields in combination with safety glasses or goggles when the potential for exposure to chemical splashes may exist.
- If repairs to injection delivery system components are necessary after the subsurface injection operations have been initiated, the injection lines must be relieved of pressure and drained before conducting repair work. See also the Lockout/Tagout section of this Handbook.
- Drums/containers of injection material shall be moved using a drum "dolly" or other appropriate material handling equipment where the weight of the drum can be properly managed and secured during the movement.
- Empty containers may require special preparation/rinsing prior to disposal. Verify requirements with the project Environmental Manager.
- Only qualified personnel, by prior training or experience, may operate the injection system delivery components/array(s).

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- Appropriate spill response materials for all chemicals must be present at the job site. Only qualified (by training and previous experience) who have proper PPE and equipment available shall provide spill response operations.
- Station a portable eye wash in the immediate work area where chemical injections are occurring, along with wash facilities for hygienic practices and PPE decontamination.
- If PPE becomes saturated and may potentially impact work clothing, dermal surfaces, or mucous membranes, change PPE immediately.
- Verify the competency and integrity of the chemical injection hoses/piping and connection points
- Confirm hose/piping rated for 100 psi.
- Verify the any cam-lock fitting on the injection hose/piping, well head, or direct push technology (DPT) rods are structurally sound and free of defects. Where hoses are used, ensure fittings have been secured to the hose surface via mechanical banding equipment to prevent whipping.
- When injecting under pressure, stand at a sufficient distance (i.e., ~ 20 feet) from the injection well head/point. Keep unessential project personnel away from the injection system, array, and well head(s) during injection operations.
- Remove/stow all unnecessary equipment and material in the area.
- The injection system/array must be monitored/attended at all times during the injection process and when not in use, components must be properly secured, de-energized, or stowed. If the system will operate without an attendant, plans for operating unattended must be in place an approved by the PM an RHSM/EM.
- All pressured lines and fittings should be 'tethered' or otherwise secured to minimize whipping or 'launching' of lines in the event of an equipment failure. Any "quick connect" type fittings (compressed air or fluid) should be secured with appropriate pins, clips to prevent accidental disengagement of the fitting during operation.
- Inspect all equipment, hoses, pressure lines, and fittings daily and prior to pressurizing.

Chemical Storage

- Some injection chemicals, such as strong oxidizers, may have stringent storage requirements per local or National Fire Codes. Verify that appropriate storage provisions are in place prior to starting work.
- NOTE: Counties and cities may have requirements specific to storing these chemicals. Also, storage and use
 of certain chemicals such as potassium permanganate and hydrogen peroxide may be subject to the new
 Chemical Facility Anti-Terrorism Standards of the Department of Homeland Security the applicability
 depends on the chemical, quantity/concentration, and type of facility. Please contact the project
 Environmental Manager to determine whether chemicals are subject to these standards.
- Chemicals must be stored in a designated, secured area with spill prevention capabilities. Review SDS or other information to determine potential incompatible materials. Incompatible materials shall not be stored together. Ensure all containers are labeled.

8.10 Compressed Gas Cylinders

(Reference CH2M HILL SOP HSE-403, Hazardous Materials Handling)

8.10.1 General

Below are the hazard controls and safe work practices to follow when working around or using compressed gas cylinders. Ensure the requirements in the referenced SOP are followed.

- Cylinders and pressure-controlling apparatus shall be inspected for defects and leakage prior to use. Damaged or defective items shall not be used. If a cylinder is found to be defective, the gas distributor shall be notified and subsequent instructions followed. If a leak should develop at a fuse plug or other safety device, the cylinder shall be removed from the work area.
- Cylinders shall be labeled with the identity of the contents. Cylinders not labeled shall be sent back to the cylinder distributor. The color of the cylinder shall not be used exclusively to identify cylinder contents.
- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinders must be secured in an upright position at all times.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.
- Eye protection (safety glasses or goggles) shall be worn when using cylinders.
- Cylinders must be shielded from welding and cutting operations and positioned to avoid being struck or knocked over; contacting electrical circuits; or exposed to extreme heat sources.
- Cylinders inside buildings shall be stored in dry, well-ventilated locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high, having a fire resistance rating of at least 0.5 hour.
- Signs indicating no smoking shall be provided for storage areas containing flammable gas cylinders.
- Complete the self-assessment checklist for compressed gas cylinders are being used.

8.10.2 Calibration Gas Cylinder Disposal

Calibration gas for field instruments is usually shipped in non-refillable DOT-39 specification cylinders. They can be identified by a code stamped into the cylinder that begins with "DOT-39, NRC" followed by a series of other numbers and letters. These cylinders cannot be refilled and are intended to be disposed of by the end user once the contents are consumed. Because of the high cost of shipping partially full cylinders to a CH2M HILL warehouse, equipment rental company, or the manufacturer, most calibration gas cylinders should be disposed of locally using this procedure.

Applicability

This procedure applies only to nonrefillable DOT-39 specification cylinders containing calibration gas that is classified by DOT as a Division 2.2 nonflammable gas. The cylinder will display the green nonflammable gas label. Calibration gas usually contains parts per million (ppm)-range concentrations of compounds such as isobutylene, hexane, or methane. This procedure does not apply to Division 2.1 flammable gasses, Division 2.3 poison gasses, corrosive gasses, or oxidizing gasses. It also does not apply to gasses contained in larger refillable DOT-specification cylinders.

Disposal Procedure

 Review the cylinder labeling and material safety data sheet (MSDS) to verify that the material in question is calibration gas containing ppm-range concentrations of materials such as isobutylene, hexane, or methane, and that the gas is classified as a Division 2.2 nonflammable gas. If the material is a flammable gas (Division 2.1), poison gas (Division 2.3) corrosive gas, oxidizing gas, or contains toxic air contaminants such as trichloroethylene, DO NOT FOLLOW THIS PROCEDURE. Contact a dangerous goods advisor or the project EM for assistance.

- 2. Attach the appropriate regulator or valve to the cylinder, open the valve, and allow the gas to vent slowly to the atmosphere in an unconfined, well ventilated area outdoors.
- 3. If a regulator is not available, depress the valve with a nonsparking tool (e.g., pencil, stick). Be sure that the cylinder is pointed away from you at all times. The valve operates the same way as the valve on a car or bicycle tire.
- 4. Wear leather work gloves and keep your hands away from the flow of gas.
- 5. Leave the valve open until all gas is discharged from the cylinder.
- 6. If the cylinder has a permanently attached valve, leave it open. If a removable regulator or valve was used, remove it from the cylinder.
- 7. Mark the cylinder as "EMPTY" or "MT."
- 8. Recycle the empty cylinder as scrap metal or dispose as solid waste after verifying that the solid waste collection company will accept this material in the trash.
- 9. If required to puncture the empty cylinder before disposal or recycling, do not attempt to do so using hand tools such as a hammer and nail or punch. Contact a dangerous goods advisor, the project EM, or health and safety manager for assistance.

8.11 Concrete Work and Masonry Construction Activities (Including well pad construction)

(Reference CH2M HILL SOP HSE-302, Concrete and Masonry)

Below are the hazard controls and safe work practices to follow when working around or performing concrete and masonry activities. Ensure the requirements in the referenced SOP are followed.

- Wear PPE to avoid contact with concrete including gloves, mud boots, hard hat, safety glasses, long sleeved shirt and long pants.
- Consult the glove supplier or the cement manufacturer's SDS for help in choosing the proper gloves. Butyl or nitrile gloves (rather than cotton or leather gloves) are frequently recommended for caustic materials such as Portland cement.
- Use only well-fitting gloves. Loose-fitting gloves let cement in. Often the use of gloves and clothing makes exposure worse when cement gets inside or soaks through the garment. Use glove liners for added comfort.
- Wash your hands before putting on gloves. Wash your hands every time that you remove your gloves.
- Dry your hands with a clean cloth or paper towel before putting on gloves.
- Protect your arms and hands by wearing a long sleeve shirt with the sleeves duct-taped to your gloves to prevent wet cement from getting inside the gloves.
- Follow proper procedures for removing gloves, whether reusing or disposing them.
- Clean reusable gloves after use. Before removing gloves, clean the outside by rinsing or wiping off any wet cement. Follow the manufacturer's instructions for glove cleaning. Place clean and dry gloves in a plastic storage bag and store them in a cool, dry place away from tools.
- Throw out grossly contaminated or worn-out gloves.
- Keep the inside of gloves clean and dry.
- Wear waterproof boots when necessary to prevent wet cement from coming into contact with your skin. It is as important to protect your legs, ankles, and feet from skin contact with wet cement as it is to protect your hands.

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- Boots need to be high enough to prevent wet cement from getting inside. Tuck pants inside and wrap duct tape around the top of the boots to prevent wet cement from entering.
- Change protective boots if they become ineffective or contaminated on the inside with wet cement while in use.
- Change out of any work clothes that become contaminated with wet cement and keep contaminated work clothes separate from your street clothes.
- When kneeling on wet cement use waterproof kneepads or dry kneeboards to prevent the knees from coming into contact with the cement.
- Wear proper eye protection when working with Portland cement.
- Perform hazard communication training for concrete. Read SDSs heed the manufacturers' recommendations for safety precautions.
- Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement
- During post-tensioning, only those personnel essential to the operation are permitted behind the tensioning jacks.
- Personnel shall not ride concrete buckets nor position themselves in areas where buckets are lifted overhead.
- Personnel shall maintain a safe distance from formwork and shoring being removed from concrete structures.
- Personnel shall maintain a safe distance from precast and lift-slab concrete being lifted into position until physically secured.
- Personnel shall not enter limited access zones during masonry wall construction.
- When CH2M HILL is in control of concrete and masonry operations, a lift slab competent person will oversee all the concrete and masonry operations.
- Complete the self-assessment checklist for concrete and masonry activities whenever those activities are being performed.

8.12 Concrete Core Drilling

(Reference CH2M HILL SOP HSE-204, Drilling)

Below are the hazard controls and safe work practices to follow when working around or performing concrete core drilling.

- Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Follow all manufacturers' operating instructions and comply with all warning labels on the equipment.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Follow all requirements for use of PPE. Minimum PPE includes hearing protection, safety glasses with side shields, safety toed boots. A face shield over safety glasses or liquid splash goggles may be required for wet coring.
- Inspect areas to be cored to ensure there are no obstructions, for example utilities on the opposite side of a wall to be cored through. Follow utility locate procedures for when coring slab on grade.
- Provide dust control (wet coring or local exhaust for dry coring) to avoid potential silica exposure.

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- Make sure that all electrical wiring is grounded.
- The power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard.
- When hydraulic coring equipment is uses, all workers must be aware of hydraulic lines running to the coring equipment. Preparations must be made for containment/clean up in the event of a ruptured hydraulic line.
- All workers must keep their hands and body away from the cutting saw/cable.
- The power supply must be disconnected when changing bits or conducting other maintenance on the equipment.
- Slippery conditions may exist in wet coring operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.
- Use the Drilling Self-Assessment checklist to evaluate coring operations.

8.13 Concrete Saw Cutting

- Ensure operators are trained and familiar with the equipment are operating the saw. Operators must read and understand the Operators Manual(s) for the equipment that will be used.
- Inspect equipment to ensure it is in proper operating condition prior to use. Equipment damage or missing parts must be corrected prior to operation.
- Cutting blades shall be the correct size, installed properly, guarded at all times, and speed should not exceed the manufacturer's suggested operating speed.
- Workers shall use the correct blade for the job and inspect it for defects before each use.
- Saws shall be maintained and kept clean from dust build-up. Workers shall not push against the saw during operation to avoid the blade jumping out of the cutting path and loss of operator control.
- Inspect areas to be sawed to ensure there are no obstructions, for example rocks or other debris. Follow utility locate procedures prior to cutting.
- Personal protective equipment (PPE) saw use shall include hard hats, safety-toed boots, safety glasses and face shields, hearing protection, and leather gloves.
- The dust created by the concrete saw needs to be controlled using the application of water or local exhaust ventilation (i.e., removes dust at the source) to reduce the amount of airborne dust generated. If dust cannot be controlled, suspend work and contact the RHSM to determine if air monitoring/respiratory protection will be necessary.
- If equipped, the power supply line (electric cord, pneumatic or hydraulic line) must be protected from damage and routed to prevent it becoming a tripping hazard. The power supply must be disconnected when changing blades or conducting other maintenance on the equipment.
- Ensure all utilities have been marked and located in accordance with the underground utilities section of this Handbook.
- Slippery conditions may exist in wet cutting operations. Water needs to be controlled during cutting and proper safety toed footwear used to minimize slip potential.

8.14 Confined Space Entry Activities

(Reference CH2M HILL, SOP HSE-203, Confined Space Entry)

A confined space is defined as a space that has all of the following characteristics:

- Large enough to allow personnel to enter the space with their entire body;
- Limited openings for entry and exit; and
- Not designed for continuous human occupancy;

Examples of possible confined spaces include underground vaults, pipelines, ducts, tunnels, storage tanks, sewers, process vessels, and pits. Entry into a confined space is defined as breaking the plane of a confined space with any part of the body.

The following requirements apply when entering a permit-required confined space (PRCS), an Alternate Procedure Confined Space, or a PRCS reclassified as a non-permit confined space (NCS). Ensure the requirements in the referenced SOP are followed.

- Entrants, Attendants, and the Entry Supervisor shall have successfully completed Confined Space Entry training.
- The appropriate confined space entry permit shall be completed as outlined in CH2M HILL SOP HSE-203, *Confined Space Entry*.
- The completed permit or certificate shall be posted for review near the space entrance point.
- The Entry Supervisor shall conduct a pre-entry briefing with all Authorized Entrants and Attendants prior to entry in accordance with SOP HSE-203.
- Entrants and Attendants shall verify that the Entry Supervisor has authorized entry and that all requirements of the permit or certificate have been satisfied prior to each entry.
- Atmospheric monitoring for oxygen, combustible gases, and potential toxic air contaminants shall be conducted at the frequency provided on the permit or certificate. Entry shall not be permitted if an atmospheric hazard is detected above acceptable safe levels. Atmospheric monitoring shall be performed in accordance with the Site Monitoring Section of the project safety plan and SOP HSE-203.
- Entrants shall evacuate the space upon orders of the Attendant or Entry Supervisor, when an alarm is sounded, or when a prohibited condition or dangerous situation is recognized.
- Entrants and Attendants shall inform the Entry Supervisor of any hazards confronted or created in the space, or any problems encountered during entry. The Entry Supervisor shall inform the owner of such issues.
- The Entry Supervisor shall provide a copy of the canceled permit or certificate to the SC for review and maintain it in the project file.
- Complete the self-assessment checklist for confined space entry whenever entries are being performed.

8.15 Cranes

(Reference CH2M HILL SOP HSE-303, Cranes)

Below are the hazard controls and safe work practices to follow when working around or operating cranes. Ensure the requirements in the referenced SOP are followed.

• Crane operators are prohibited from using any wireless device while operating a crane. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a

certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.

- Cranes shall be operated by a certified crane operator. After November 10, 2014, only operators possessing a certificate from a nationally accredited testing organization, an audited employer training program, or U.S. military or state-issuing agency will be authorized to operate cranes.
- The crane's operations manual and load chart specifically designed for the crane shall be in the crane at all times.
- The crane must have a current annual inspection to include load test certification (within the last 12 months) that meets all state and federal safety standards. Documentation of this inspection must be available for review.
- A competent person will inspect the crane daily to ensure it is in safe operating condition. The daily crane inspection log provided within the crane manufacturer's operations manual shall be used. See also the requirements for monthly inspections, among others, in SOP HSE-303.
- All rigging equipment must be inspected by a competent person prior to use for signs of excessive wear; equipment found to be damaged will be tagged and removed from service.
- A qualified and competent Assembly/Disassembly (A/D) Director shall be assigned when cranes must be assembled onsite. The A/D Director is responsible for ensuring the crane is assembled and disassembled according to manufacturer requirements; performing training for the A/D crew; and ensuring sufficient ground conditions exist for crane placement; among other responsibilities (see SOP HSE-303).
- The assembly/disassembly process must comply with requirements in HSE-303, including having an AHA for the task.
- A critical lift plan shall be prepared when the lift is estimated to be greater than 75 percent of the crane capacity or when two cranes will be used to make a lift.
- A pre-lift meeting will be conducted to include all parties involved in that day's crane operation.
- Only one qualified person shall be designated to signal the crane operator. This person shall be thoroughly familiar with the ANSI standard method of hand signals and an illustration of these signals shall be posted at the job site.
- No personnel shall be permitted under the load at any time.
- Tag lines shall be attached to every load being made by the crane.
- The swing radius of the rear rotating superstructure (counterweight) of the crane shall be barricaded and no entrance allowed.
- Suspended loads shall not pass over workers or occupied buildings at any time.
- Complete the self-assessment checklist for crane-suspended personnel platforms whenever they are being used.
- CH2M HILL employees exposed to hazards posed by crane operations, must be trained in hazards awareness and control procedures. See requirements for training in HSE-303.

Power Line Safety

It must be determined whether equipment operations including assembly/disassembly, positioning, and crane operation (including traveling with a load) will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.
If equipment operations are within proximity of aforementioned distances to power lines, one of the following options must be implemented to prevent encroachment and electrocution:

- Option 1: Deenergize and ground the power. Confirm from the utility/operator that the power line has been deenergized and visibly grounded at the worksite
- Option 2: If the voltage is not determined, ensure that no part of the equipment, load line, or load (including rigging and lifting accessories), gets closer than 20 feet (6.1m) by:
 - Conduct a planning meeting with the operator and other workers in the area to review the actions that will be taken to prevent encroachment and electrocution. Training requirements for working around energized power lines are described in Section 6.0, Training.
 - Use non-conductive tag lines.
 - Erect and maintain an elevated warning line, barricade or line of signs in view of the operator, either with flags or other high-visibility markings at 20 feet (1.6m) from the power line. A spotter must be used when the operator does not have clear line of sight to the elevated warning line.
 - To prevent encroachment, the operator can use a proximity alarm, or position a dedicated spotter with visual aids to demarcate the encroachment and constant communication access to the operator.

If the line voltage can be determined, and if any part of the equipment, line load or load (including rigging and lifting accessories) would encroach within that specified distance listed in Table 1, then the requirements listed in Option 2 must be implemented.

Voltage (nominal, kV, alternating current)	Minimum Clearance – Feet (meters)
Up to 50	10
Over 50 to 200	15
Over 200 to 350	20
Over 350 to 500	25
Over 500 to 750	35
Over 750 to 1000	45
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

TABLE 1 Minimum Clearance Distances

For equipment traveling within 20 feet (6.1m), under or near power lines without a load, the clearance distances described in Table 2 must be maintained and the following actions implemented.

- A dedicated spotter is assigned during equipment travel, positioned to effectively gauge the clearance distance, and is in continuous communication with the operator.
- During equipment travel, the boom/mast and support system are sufficiently lowered to ensure clearance distances are maintained, along with taking into consideration of the effects of speed and terrain.

TABLE 2

Minimum	Clearance	Distances	While	Traveling	With No Load	
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Voltage (nominal	, kV, alternating current)
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Minimum Clearance – Feet (meters)

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Up to 0.75	4
Over 0.75 to 50	6
Over 50 to 345	10
Over 345 to 750	16
Over 750 to 1000	20
Over 1000	Established by the utility owner/operator or by a qualified registered professional engineer in electrical power transmission and distribution

8.16 Crystalline Silica

(Reference CH2M HILL SOP HSE-511, Crystalline Silica)

CH2M HILL subcontractors shall control employee exposure to crystalline silica when exposures are at or above the ACGIH TLV of 0.025 mg/m³ by submitting for review and approval a crystalline silica exposure monitoring plan. The elements of an exposure monitoring plan include, but are not limited to the following:

- A bulk sample representative of the material to be demolished must be sent with the air monitoring sample media for analysis;
- Initial monitoring and personal air sampling must be conducted to determine the potential worker exposure to respirable crystalline silica;
- Real-time particulate monitors with a 10 micron respirable size fraction attachment may be used as part of the initial and ongoing monitoring plan to evaluate the potential worker exposure. This must include an action level established by their corporate or site health and safety professional and include actions required (e.g., implement engineering, administrative controls, respiratory protection);

Other exposure control measures include:

- Maintaining surfaces as clean as practicable to minimize accumulation of crystalline silica containing particulate material;
- Clean surfaces with a HEPA-filter vacuum or equivalent method;
- Implement dust suppression during demolition;
- Restricting access to the work area where crystalline silica exposure may exist to only those authorized to perform work or enter the area;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in these areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and

8.17 Demolition

(Reference CH2M HILL SOP HSE-305, Demolition)

This section is applicable to all forms of demolition. Demolition is defined as the removal or dismantling of structures or equipment by disassembly.

An engineering survey shall be completed prior to start of demolition operations. The survey shall determine the condition of the structure framing, floors, and walls; the presence of asbestos, polychlorinated biphenyls (PCBs), lead paint, or other regulated hazardous substances; the presence of hazardous materials in tanks, pipes, and equipment; and the possibility of unplanned collapse of any portion of the structure. Any adjacent structure where

personnel may be exposed shall also be similarly evaluated. The survey shall be conducted by a competent person and a written record of the survey findings shall be maintained at the project site.

The demolition contractor working on this project will provide CH2M HILL with a demolition safety plan prior to the start of work. CH2M HILL will use this plan to verify that the subcontractor is implementing the necessary safety precautions during this activity. In addition, the following safety precautions shall be implemented by CH2M HILL personnel. Below are the hazard controls and safe work practices to follow when working around or performing demolition. Ensure the requirements in the referenced SOP are followed.

- Appropriate warning and instructional safety signs shall be conspicuously posted where necessary.
- Fugitive dust must be controlled during demolition by using water spray or other methods.
- Remain a safe distance from the demolition zone to reduce exposure to fragmentation of glass, steel, masonry, and other debris during demolition operations.
- Do not enter the demolition zone unless completely necessary, and only after the competent person has assessed the condition of the structure and has authorized entry.
- Follow all requirements established by the competent person. The competent person shall inform personnel of the areas that are safe to enter and the areas where entry is prohibited. When possible, the competent person should escort CH2M HILL personnel while in the demolition zone.
- All demolition activities that may affect the integrity of the structure or safety of personnel must cease until personnel have exited the demolition zone.
- During the course of demolition, work areas, passageways, stairs, ladders, and exits shall be kept free of demolition debris.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted overhead of personnel
- Proper control measures shall be in place before welding or cutting on surfaces covered by coatings containing flammable or hazardous materials such as lead, cadmium, zinc, etc. Highly flammable or toxic coatings may require stripping of the coating a sufficient distance from the area to be heated. Welding and cutting shall be performed in accordance with the provisions of OSHA 1926, Subpart J, "Welding and Cutting." Follow "Welding and Cutting" SOP HSE-314.

The following lead-exposure-control procedures will be implemented during demolition operations involving potential exposure to lead:

- Site personnel will be provided lead-awareness training;
- Site personnel will be provided with hand-washing facilities and will wash their hands daily;
- An excavator equipped with hydraulic shears will be used only to cut painted wooden, concrete, and metal structures;
- Neither hand-held band/chop saws nor torch cutting equipment will be used on painted surfaces without proper PPE and engineering controls in place or removal of paint prior to cutting;
- During all demolition operations to control potential exposures to LBP, wet methods using water mist will be used;
- A direct-reading dust monitor will be used to monitor demolition operations that pose a potential leadexposure hazard (that is, those with an action level requiring that additional dust control measures be employed and/or that respiratory protection be used.);
- Personal air samples will be collected and analyzed for lead to confirm that no personnel are exposed to levels above the lead action level of 30 micrograms per cubic meter (μg/m³); and

- The selection of respiratory protection and other exposure controls will be based on the most recent exposure monitoring results obtained from the lead-exposure-competent person.
- For more information see CH2M HILL SOP HSE-508, Lead.

8.18 Drilling Safety

(Reference CH2M HILL SOP HSE-204, Drilling)

Below are the hazard controls and safe work practices to follow when working around or performing drilling. Ensure the requirements in the referenced SOP are followed.

- When considering drilling at sites with nearby monitoring wells, particularly in cases where drilling methods utilize pressurized fluids (air or water), consider the potential risk of hydraulic communication between the drilling location and the adjacent wells and/or other subsurface conduits.
- The drill rig is not to be operated in inclement weather.
- The driller is to verify that the rig is properly leveled and stabilized before raising the mast.
- Personnel should be cleared from the sides and rear of the rig before the mast is raised.
- The driller is not to drive the rig with the mast in the raised position.
- The driller must check for overhead power lines before raising the mast. Maintain a minimum distance of 10 feet (3 meters) between mast and overhead lines (<50 kV) and an additional 0.4 inches for every 1 kV over 50kV. Verify the voltage of nearby overhead power lines to determine the minimum distance.
- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Personnel should stand clear before rig startup.
- The driller is to verify that the rig is in neutral when the operator is not at the controls.
- Become familiar with the hazards associated with the drilling method used (cable tool, air rotary, hollow-stem auger, etc.).
- Do not wear loose-fitting clothing, watches, etc., that could get caught in moving parts.
- Do not smoke or permit other spark-producing equipment around the drill rig.
- The drill rig must be equipped with a kill wire or switch, and all personnel are to be informed of its location.
- Be aware and stand clear of heavy objects that are hoisted overhead.
- The driller is to verify that the rig is properly maintained in accordance with the drilling company's maintenance program.
- The driller is to verify that all machine guards are in place while the rig is in operation.
- The driller is responsible for housekeeping (maintaining a clean work area).
- The drill rig should be equipped with at least one fire extinguisher.

- If the drill rig comes into contact with electrical wires and becomes electrically energized, do not touch any part of the rig or any person in contact with the rig, and stay as far away as possible. Notify emergency personnel immediately.
- Use the drilling self-assessment checklist to evaluate drilling operations.

8.18.1 Air Rotary Drilling

- When a hydraulic communication hazard may exist, do not perform work at an adjacent structure or conduit when drilling, and be mindful of potential line-of-fire hazards. Evaluate the possibility of:
 - Increasing the distance between the proposed drilling site and the existing structure(s);
 - Abandon the adjacent structure(s)/conduit(s);
 - Consider use of an alternative drilling technology that minimizes propagation of pressures in the borehole to the adjacent formation (e.g., casing methods, continuous override methods, rotosonic); and
 - Ensure that hydraulic communication risks are addressed in your AHA.
- If drilling near a previously installed well, remove or loosen the well cap of that well to relieve pressure that may build during drilling.
- Stay clear of nearby wells that aren't protected by a secured steel casing/monument as a steel casing should provide protection from the inner well in the event of a pressure buildup.
- When opening a well in the vicinity of where air rotary drilling is being performed, or when opening a newly installed well via air rotary methods, remove the cap slowly to relieve pressure, keeping your head away from the line of fire in case the cap does pop off.

8.18.2 Cold Weather Drilling

- When possible, secure a tarp or plastic sheeting on the ground of the drilling work area overnight to reduce buildup of ice/snow.
- Place non-slip pads near work area and clean off regularly.
- Keep the drilling area clear of soil or cuttings at the surface, especially if soil is very wet, to prevent freezing and slipping/tripping hazards.
- Work at a slower pace to avoid slips
- Evaluate alternate methods for extreme conditions with PM/HSM.

8.19 Drum and Portable Tank Handling

Below are the hazard controls and safe work practices to follow when overseeing the movement of drums or when handling drums:

- Ensure that personnel are trained in proper lifting and moving techniques to prevent back injuries;
- Ensure drum or tank bungs and lids are secured and are labeled prior to moving;
- Ensure that drums and tanks remain covered except when removing or adding material or waste. Covers and/or lids will be properly secured at the end of each workday;
- Provide equipment to keep the operator removed from the drums to lessen the likelihood of injury. Such equipment might include: a drum grappler attached to a hydraulic excavator; a small front-end loader, which can be either loaded manually or equipped with a bucket sling; a rough terrain forklift; Roller conveyor equipped with solid rollers; drum carts designed specifically for drum handling;

- Make sure the vehicle selected has sufficient rated load capacity to handle the anticipated loads, and make sure the vehicle can operate smoothly on the available road surface;
- Ensure there are appropriately designed Plexiglas cab shields on loaders, backhoes, etc., when handling drums containing potentially explosive materials;
- Equipment cabs should be supplied with fire extinguishers, and should be air-conditioned to increase operator efficiency;
- Supply operators with appropriate respiratory protective equipment when needed;
- Ensure that drums are secure and are not in the operator's view of the roadway;
- Prior to handling, all personnel should be warned about hazards of handling;
- Before moving anything, determine the most appropriate sequence in which the various drums, portable tanks, and other containers should be moved (e.g., small containers may have to be removed first to permit heavy equipment to enter and move the drums;
- Overpack drums and an adequate volume of absorbent should be kept near areas where minor spills may occur;
- Use containers or overpacks that are compatible with the waste or materials;
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance;
- Allow enough aisle space between drum pallets and between drums and other equipment that the drums can be easily accessed (at least 2 to 3 feet) by fire control equipment and similar equipment.; and
- Make sure that a spill kit is available in drum or tank storage areas (or where liquids are transferred from one vessel to another).

8.20 Drum Sampling Safety

Personnel are permitted to handle and/or sample drums containing certain types of waste (drilling waste, investigation-derived waste, and waste from known sources) only. Handling or sampling drums with unknown contents requires a plan revision or amendment approved by the RHSM. The following control measures will be taken when sampling drums:

- Minimize transportation of drums;
- Sample only labeled drums or drums from a known waste stream;
- Do not sample bulging or swollen drums. Contact the RHSM;
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open;
- Use the proper tools to open and seal drums;
- Reseal bung holes or plugs whenever possible;
- Avoid mixing incompatible drum contents;
- Sample drums without leaning over the drum opening;
- Transfer/sample the content of drums using a method that minimizes contact with material;
- Use the PPE and perform air monitoring as specified in the PPE and Site Monitoring sections of the project safety plan;
- Take precautions to prevent contaminated media from contacting the floor or ground, such as having plastic under the sampling area, having a spill kit accessible during sampling activities; and

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• If transferring/sampling drums containing flammable or combustible liquids, drums and liquid transfer equipment should be grounded and bonded to reduce the potential of a static discharge.

8.21 Earthmoving Equipment

(Reference CH2M HILL, SOP HSE-306, Earthmoving Equipment)

Below are the hazard controls and safe work practices to follow when working around or operating heavy equipment. Ensure the requirements in the referenced SOP are followed.

- CH2M HILL authorizes only those employees qualified by training or previous experience to operate material handling equipment.
- CH2M HILL employees must be evaluated prior to operating earthmoving equipment by a CH2M HILL earthmoving equipment operator evaluation designated person. This evaluation will be documented according to SOP HSE-306, Earthmoving Equipment.
- Heavy equipment operators are prohibited from using any wireless device while operating equipment. Equipment must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Equipment must be checked at the beginning of each shift to ensure the equipment is in safe operating condition and free of apparent damage. The check should include: service brakes, parking brakes, emergency brakes, tires, horn, back-up alarm, steering mechanism, coupling devices, seat belts and operating controls. All defects shall be corrected before the equipment is placed in service. Documentation of this inspection must be maintained onsite at all times (use the Earthmoving Equipment Inspection form if operated by CH2M HILL).
- Equipment must be on a stable foundation such as solid ground or cribbing; outriggers are to be fully extended.
- Equipment must not be used to lift personnel; loads must not be lifted over the heads of personnel.
- Equipment, or parts thereof, which are suspended must be substantially blocked or cribbed to prevent shifting before personnel are permitted to work under or between them. All controls shall be in a neutral position, with the motors stopped and brakes set.
- Equipment which is operating in reverse must have a reverse signal alarm distinguishable from the surrounding noise or a signal person when the operators view is obstructed.
- When equipment is used near energized power lines, the closest part of the equipment must be at least 10 feet (3 meters) from the power lines less than 50 kilovolts (kV). Provide an additional 4 feet (1.2 meters) for every 10 kV over 50 kV. A person must be designated to observe clearances and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means. All overhead power lines must be considered to be an energized until the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Underground utility lines must be located before excavation begins; refer to the Utilities (underground) section.
- Operators loading and unloading from vehicles are responsible for seeing that vehicle drivers are in the vehicle cab or in a safe area.
- The parking brake shall be set whenever equipment is parked; wheels must be chocked when parked on inclines.

• When not in operation, the blade or bucket must be blocked or grounded; the master clutch must be disengaged when the operator leaves the cab. When equipment is unattended, power must be shut off, brakes set, blades or buckets landed and shift lever in neutral.

8.22 Energized Electrical Work

(Reference CH2M HILL SOP HSE-221, Energized Electrical)

Energized electrical work is defined as work performed on or near energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a Limited Approach Boundary.

All electrical systems shall be considered energized unless lockout/tagout procedures are implemented and verified.

Electrical wiring and equipment shall be de-energized prior to conducting work unless it can be demonstrated that de-energizing introduces additional or increased hazards or is unfeasible due to equipment design or operational limitations. When energized electrical work is the only means that work can be performed, all requirements of SOP HSE-221 must be implemented including the following:

- Only qualified personnel are permitted to work on unprotected energized electrical systems. These personnel shall complete the CH2M HILL energized electrical safety training (refresher training required every 3 years) and must be designated by their supervisor as an Energized Electrical Qualified Person (EEQP). Release of victim, CPR and AED training must be completed by these personnel annually. A skill demonstration must be performed by the EEQP while wearing the necessary PPE and using the required tools and equipment to fulfill the qualification which shall be verified by their supervisor and RHSM.
- An Electrical Hazard Analysis must be performed to identify energized electrical safe work practices before any person approaches exposed live parts within the Limited Approach Boundary (as determined by the shock hazard analysis), by performing both shock hazard analysis and flash hazard analysis, which comprise the electrical analysis.
- The Energized Electrical Work Permit must be completed prior to working on unprotected energized electrical systems.
- CH2M HILL employees designated as qualified persons working on live parts of energized electrical systems 480 volts and above shall implement the buddy system. This means that two EEQPs must be engaged in this work. Working on live parts of energized electrical systems 480 volts and above means actual contact with live parts or working within the Prohibited Approach Boundary, which is one inch (2.54 cm) for 480 volt systems.
- The buddy system requires the presence of an additional EEQP who shall stand by and render assistance, or summon help for the first person, in the event the first person is inadvertently shocked while performing the work. The second person shall not be assigned to additional distracting duties or tasks while the energized electrical work is being performed and shall know the location of the isolation device(s) for the equipment being worked on.
- Workers designated as qualified persons shall wear the required electric shock and arc-flash PPE, as specified by the qualified person responsible for the energized electrical operations.
- Safety signs, safety symbols or incident prevention tags, meeting applicable American National Standards Institute (ANSI) Standards, shall be used where necessary to warn employees about electrical hazards.
- Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas containing live parts. Conductive barricades shall not be used where it may cause an electrical hazard. Barricades shall be placed no closer than the Limited Approach Boundary.

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- If signs and barricades do not provide sufficient warning and protection from electrical hazards, an
 attendant shall be stationed to warn and protect unqualified employees. The primary duty and
 responsibility of an attendant providing manual signaling and alerting shall be to keep unqualified
 employees outside a work area where the unqualified employee might be exposed to electrical hazards. An
 attendant shall remain in the area as long as there is a potential for employees to be exposed to the
 electrical hazards.
- Employees shall not perform tasks near exposed energized parts where lack of illumination or an obstruction precludes observation of the work. Employees shall not reach blindly into areas that may contain energized parts.
- Work shall be performed in accordance with National Fire Protection Association (NFPA) 70E requirements (2012 edition).
- Follow all control measures and procedures identified on the Energized Electrical Work Permit and the AHA.

8.23 Excavation Activities

(Reference CH2M HILL SOP HSE-307, Excavation and Trenching Safety)

The requirements in this section shall be followed whenever excavation is being performed. Refer to the Earthmoving Equipment section and SOP for additional requirements applicable to operating/oversight of earthmoving equipment. Below are the hazard controls and safe work practices to follow when working around or performing excavation. Ensure the requirements in the referenced SOP are followed.

- If the project site is suspected of munitions or explosives of concern (MEC) contamination, requirements of the *Explosives Usage and Munitions Response (MR)* SOP HSE-610 shall be followed. MECs include material potentially presenting an explosive hazard (MPPEH), discarded military munitions, materials that present a potential explosive hazard, chemical warfare materials, munitions constituents, and contaminated soil or groundwater. "Down-hole" avoidance support may be required to prevent accidental contact with MPPEH. Safety requirements will be based on the risk assessment identified within the MR (safety) ORE (Opportunity Risk Evaluation).
- Do not enter the excavations unless completely necessary, and only after the excavation competent person has completed their daily inspection and has authorized entry. An inspection shall be conducted by the competent person prior to the start of work, as needed throughout the shift, after every rainstorm, and after any hazard increasing occurrence. Documentation of the inspection must be maintained onsite at all times.
- Follow all excavation entry requirements established by the excavation competent person and any excavation permit being used.
- Sloping, benching, shoring, shielding, or other protective systems are required to protect personnel from cave-ins except when the excavation is made entirely in stable rock or is less than 5 feet deep (1.5 meters) and there is no indication of possible cave-in, as determined by the excavation competent person. Protective systems for excavations deeper than 20 feet (6.1 meters) must be designed or approved by a registered professional engineer.
- Trenches greater than 4 feet (1.2 meters) deep shall be provided with a ladder, stairway, or ramp positioned so that the maximum lateral travel distance is no more than 25 feet (7.6 meters).
- The atmosphere of excavations greater than 4 feet (1.2 meters) deep shall be tested prior to entry when a hazardous atmosphere exists or could reasonably be expected to exist, such as excavating landfills, hazardous waste dumps; or areas containing sewer or gas utility systems, petroleum distillates, or areas where hazardous substances are stored nearby.

- Spoil piles, material, and equipment must be kept at least 2 feet (61 centimeters) from the edge of the excavation, or a retaining device must be used to prevent the material from falling into the excavation.
- Excavations shall not be entered when:
 - Protective systems are damaged or unstable;
 - Objects or structures above the work location may become unstable and fall into the excavation;
 - The potential for a hazardous atmosphere exists, unless the air has been tested and found to be at safe levels; or
 - Accumulated water exists in the excavation, unless precautions have been taken to prevent excavation cave-in.
- The excavation self-assessment checklist shall be used to evaluate excavations prior to entry.

Excavation Operations

Refer to the Excavation Entry section when entering excavations controlled by other parties. When CH2M HILL performs the excavating, a CH2M HILL excavation competent person will oversee all excavation operations and entry into excavations. The competent person shall:

- Complete the CH2M HILL Excavation Permit to ensure HSE requirements have be satisfied during excavation activities;
- Complete the CH2M HILL Daily Excavation Inspection Checklist to ensure HSE requirements have be satisfied, document that an inspection has been conducted, and to authorize entry into the excavation. A new Checklist shall be completed each day, authorizing excavation entry. Inspections should be continued as needed throughout the work shift, and after any event that could increase the potential for cave-in (e.g., rainfall); and
- Conduct daily safety briefings prior to excavation entry.

8.24 Fall Protection Activities

(Reference CH2M HILL, SOP HSE-308, Fall Protection)

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are exposed to unprotected heights. Ensure the requirements in the referenced SOP are followed.

- Fall protection systems must be used to eliminate fall hazards when performing construction activities at a height of 6 feet (1.8 meters) or greater and when performing general industry activities at a height of 4 feet (1.2 meters) or greater.
- CH2M HILL staff exposed to fall hazards must complete initial fall protection training by completing either the CH2M HILL 10-Hour Construction Safety Awareness training course or the Fall Protection computerbased training module. Staff must also and receive project-specific fall protection training using the fall protection evaluation form attached to the project safety plan. Staff shall not use fall protection systems for which they have not been trained.
- The SC or designee must complete the Project Fall Protection Evaluation Form and provide project-specific fall protection training to all CH2M HILL staff exposed to fall hazards.
- The company responsible for the fall protection system shall provide a fall protection competent person to inspect and oversee the use of fall protection system. CH2M HILL staff shall be aware of and follow all requirements established by the fall protection competent person for the use and limitation of the fall protection system.

- When CH2M HILL designs or installs fall protection systems, staff shall be qualified as fall protection competent persons or work directly under the supervision of a CH2M HILL fall protection competent person.
- When horizontal lifelines are used, the company responsible for the lifeline system shall provide a fall protection qualified person to oversee the design, installation, and use of the horizontal lifeline.
- Inspect personal fall arrest system components prior to each use. Do not use damaged fall protection system components at any time, or for any reason. Fall protection equipment and components shall be used only to protect against falls, not to hoist materials. Personal fall arrest systems that have been subjected to impact loading shall not be used. SC shall periodically inspect CH2M HILL fall protection equipment using the Fall Protection Inspection Log form.
- Personal fall arrest systems shall be configured so that individuals can neither free-fall more than 6 feet (1.8 meters) or contact any lower level.
- Only attach personal fall arrest systems to anchorage points capable of supporting at least 5,000 pounds (2,268 kg). Do not attach personal fall arrest systems to guardrail systems or hoists.
- Remain within the guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted. Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders to increase working height on top of platforms protected by guardrails.
- Only one person shall be simultaneously attached to a vertical lifeline and shall also be attached to a separate independent lifeline.

8.25 Flight Line Safety

Always assume that the airfield is active. An active airfield means there is the possibility, even if an area is "closed", that aircraft or other vehicles will need access on or through a work area. There is always the potential for an incursion. If in an area of the airfield where radio contact with the control tower is required, the potential for miscommunication exists. Any mistake in communication has the potential to cause a problem with Air Operations. When maneuvering on the airfield, there are fuel trucks, helicopter rotors, jet blast, etc., all of which are potential hazards for workers. Pilots of aircraft do not expect workers to be on the airfield. If equipment is not properly marked, it may go unnoticed by pilots and present the potential for an incursion.

An aircraft <u>always</u> has the right of way. When working in a confined area that is "closed" to traffic, outline the work area with traffic cones or barricades that will provide a warning to other airfield traffic. This will also serve to keep vehicles from running through wet paint. Have one person designated as the point of contact who will be responsible for monitoring the radio and communicating with the control tower. That person shall be properly trained in the use of the radio, and check in daily with Air Operations to confirm work areas. Properly train workers to be aware of airfield operations going on around them, to give way to all moving aircraft, to allow great distances from aircraft, parked or running, when maneuvering on airfield.

It is inherent upon the contractor to be visible to everyone operating on the airfield. Orange and white checkered flags, flashing amber beacons, cones and/or barricades should be in good condition and clearly visible.

Speed limits on airfield area are enforced. Speed limits on an airfield are very low relative to speeds on the roads. Speeding on the airfield can lead to a possible incursion. Restricted areas, particularly on a military installation, must be strictly enforced. They are usually outlined with a red line and often have certain "Entry Control Points" painted along the red line where entry into the area is permitted. Entry into the restricted area without permission may subject the workers to arrest.

There are safety areas around runways on the airfield. All equipment and materials must be stored behind these areas. If a crew working on the runway is instructed to clear the runway, all workers and equipment must be moved beyond the safety area until given clearance by the control tower to return to the runway.

8.26 Forklift Operations

(Reference CH2M HILL, SOP HSE-309, Forklifts)

Below are the hazard controls and safe work practices to follow when working around or operating forklifts. Ensure the requirements in the referenced SOP are followed.

- Forklift operators are prohibited from using any wireless device while operating forklifts. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- A rated lifting capacity must be posted in a location readily visible to the operator.
- A forklift truck must not be used to elevate employees unless a platform with guardrails, a back guard, and a kill switch is provided on the vehicle. When guardrails are not possible, fall arrest protection is required.
- The subcontractor operating the forklift must post and enforce a set of operating rules for forklift trucks.
- Only certified forklift operators shall operate forklifts.
- Stunt driving and horseplay are prohibited.
- Employees must not ride on the forks.
- Employees must never be permitted under the forks (unless forks are blocked).
- The driver must inspect the forklift once a shift and document this inspection.
- The operator must look in the direction of travel and must not move the vehicle until all persons are clear of the vehicle.
- Forks must be carried as low as possible.
- The operator must lower the forks, shut off the engine, and set the brakes (or block the wheels) before leaving the forklift operator's position unless maintenance or safety inspections require the forklift to be running.
- Trucks must be blocked and have brakes set when forklifts are driven onto their beds.
- Extreme care must be taken when tilting elevated loads.
- Every forklift must have operable brakes capable of safely stopping it when fully loaded.
- Forklifts must have parking brakes and an operable horn.
- When the operator is exposed to possible falling objects, industrial trucks must be equipped with overhead protection (canopy).
- If using certified CH2M HILL forklift operators—forklifts must be inspected and documented daily using the forklift inspection form.

8.27 Groundwater Sampling/Water Level Measurements

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are performing groundwater sampling and/or water level measurements.

- Full coolers are heavy. Plan in advance to have two people available at the end of the sampling effort to load full coolers into vehicles. If two people won't be available use several smaller coolers instead of fewer large ones.
- Wear the appropriate PPE when sampling, including safety glasses, nitrile gloves, and steel toe boots (see PPE section of the project safety plan).

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- Monitor headspace of wells prior to sampling to minimize any vapor inhalation (refer to the "Site Monitoring" section of the project safety plan).
- Use caution when opening well lids. Wells may contain poisonous spiders and hornet or wasp nests.
- Use the appropriate lifting procedures (see CH2M HILL SOP HSE-112) when unloading equipment and sampling at each well.
- Avoid sharp edges on well casings.
- If dermal contact occurs with groundwater or the acid used in sample preservation, immediately wash all affected skin thoroughly with soap and water.
- Avoid eating and drinking on site and during sampling.
- Use ear plugs during sampling if sampling involves a generator.
- Containerize all purge water and transport to the appropriate storage area.
- Use two people to transport full coolers/containers whenever possible. If two people are not available use a dolly to move coolers. If the coolers weigh more than 40 pounds Attachment 1 of the HSE-112, *Manual Lifting,* shall be completed by the SC. If the coolers weigh more than 50 pounds they should never be lifted by one person.

8.28 Hand and Power Tools

(Reference CH2M HILL, SOP HSE-210, Hand and Power Tools)

Hands are one of the most complex parts of the body. Every employee uses their hands to help them make a living. There are more on-the-job injuries to hands than any other body part.

Below are the hazard controls and safe work practices to follow when personnel or subcontractors are using hand and power tools. Ensure the requirements in the referenced SOP are followed.

General

- Always select the right tool for the job;
- Keep cutting tools sharp—less force will be needed for the cut. Do not use pocket knives—only safety cutting tools and if using these be sure to comply with the "Knife Use" section of this Handbook;
- Carry and store tools correctly and never put sharp or pointed tools in your pocket or belt;
- Tools shall be inspected prior to use and damaged tools will be tagged and removed from service;
- Store tools properly in a place where they will not be damaged or come in contact with hazardous materials; and
- Tools used in an explosive environment must be rated for work in that environment (that is, intrinsically safe, spark-proof, etc.).

Hand and Power Tools

- Hand and power tools will be used for their intended use and operated in accordance with manufacturer's instructions and design limitations;
- Screwdrivers are one of the most used and abused tools, never:
 - Hammer with a screwdriver
 - Use as a pry bar
 - Use with a broken handle

- Use with worn out tips
- Maintain all hand and power tools in a safe condition;
- When possible, use power tools over hand tools. Powered tools tend to require less exertion and reduce repetitive motion. Be sure that the weight of a powered tool (and cording) does not create additional force issues.
- Whenever possible, select tools that use a full-hand power grip rather than a precision finger grip. The greater the efforts to maintain control of a hand tool, the higher the potential for injury. A compressible gripping surface rather than hard plastic should be used.
- Avoid repetitive trigger-finger actions. Select tools with large switches that can be operated with all four fingers.
- When possible, use tools with extension handles that let you stand up while performing a floor-level task (extension handles must be manufacturer-approved)
- To lessen vibration:
 - Pad tool handles with a soft compressible surface
 - Use vibration damping (gel filled) gloves
 - Select tools (hammers and chippers) with built in damping systems (springs/hydraulics)
- Maintain straight wrists. Avoid bending or rotating the wrists; a variety of bent-handle tools are commercially available.
- Avoid static muscle loading. Reduce both the weight and size of the tool. Do not raise or extend elbows when working with heavy tools.
- Use PPE (such as gloves, safety glasses, earplugs, and face shields) when exposed to a hazard from a tool;
- Do not carry or lower a power tool by its cord or hose;
- Portable power tools will be plugged into GFCI protected outlets;
- Portable power tools will be Underwriters Laboratories (UL) listed and have a three-wire grounded plug or be double insulated;
- Disconnect tools from energy sources when they are not in use, before servicing and cleaning them, and when changing accessories (such as blades, bits, and cutters);
- Safety guards on tools must remain installed while the tool is in use and must be promptly replaced after repair or maintenance has been performed;
- If a cordless tool is connected to its recharge unit, both pieces of equipment must conform strictly with electrical standards and manufacturer's specifications; and

Machine Guarding

- Ensure that all machine guards are in place to prevent contact with drive lines, belts, chains, pinch points or any other sources of mechanical injury;
- Unplugging jammed equipment will only be performed when equipment has been shut down, all sources of energy have been isolated and equipment has been locked/tagged and tested; and
- Maintenance and repair of equipment that results in the removal of guards or would otherwise put anyone at risk requires lockout of that equipment prior to work.

8.29 Haul Trucks

Below are the hazard controls and safe work practices to follow when working around or operating haul trucks:

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- Haul truck operators are prohibited from using any wireless device while operating trucks on site. Trucks must be stopped before using devices such as two way radios or cell phones. If a wireless device is required for a certain operation, the PM and RHSM must authorize the wireless use on a case by case basis and make sure limitations are addressed in the project safety plan.
- Haul truck operators should be familiar with their equipment and inspect all equipment before use;
- Haul truck operators should ensure all persons are clear before operating truck or equipment. Before moving operators should sound horn or alarm, all equipment should be equipped with a working back up alarm;
- Haulage trucks or equipment with restricted visibility should be equipped with devices that eliminate blind spots;
- Employees should stay off haul roads. When approaching a haul area, employees should make eye contact and communicate their intentions directly with the equipment operator;
- If possible minimize steep grades on haul roads;
- Where grades are steep provide signage indicating the actual grade as well as measures for a runaway truck;
- Trucks are to be operated within the manufacturer's recommendations (for example- retarder charts indicate the combination of loads, grades and speeds that should not be exceeded if the truck's retarder is to work properly to ensure the truck does not descend grade at speeds greater than listed);
- Haul roads should be well lit, sufficiently wide (at least 50 percent of the width of the equipment on both sides of road) and equipped with reflectors to indicate access points;
- Haul roads should have adequate right-of-way signs indicating haul directions;
- Haul trucks will follow designated haul roads; and
- Haul trucks will comply with posted speed limits.

8.30 Hoists

(Reference CH2M HILL SOP HSE-315, Hoists)

- Below are the hazard controls and safe work practices to follow when working around or operating hoists. Ensure the requirements in the referenced SOP are followed.
- Manufacturer's specifications and limitations applicable to the operation of material hoists shall be followed. Where manufacturer's specifications are not available, the limitations assigned to the equipment shall be based on the determinations of a professional engineer competent in the field.
- Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on hoists.
- Hoisting ropes shall be installed in accordance with the wire rope manufacturer's recommendations.
- The installation of live booms on hoists is prohibited.
- Operating rules shall be established and posted at the operator's station of on hoists.
- No person shall be allowed to ride on material hoists except for the purposes of inspection and maintenance.
- All entrances of the hoistways shall be protected by substantial gates or bars, which guard the full width of the landing entrance.

- Overhead protective coverings of 2-inch planking, ³/₄-inch plywood, or other solid material of equivalent strength, shall be provided on the top of every material host cage or platform.
- All hoistway entrance bars and gates shall be painted with diagonal contrasting colors, such as black and yellow.
- A qualified hoist operator will operate, inspect, maintain and oversee all hoist operations. The SC or designee shall verify hoist operator qualifications (e.g., operator to provide for the type of hoist being operated—years of experience, training, background).
- CH2M HILL employees who are required to operate hoists shall read the hoist manufacturer's operations and maintenance manual, be evaluated and approved as qualified hoist operators. The CH2M HILL may require operators to complete separate hoist operations training, provided by commercial training specialists.

8.31 Hydrogen Sulfide

Hydrogen sulfide (H2S) is a colorless, toxic, and flammable gas responsible for the odor of rotten eggs. It often results from the bacterial break down of organic matter in the absence of oxygen, such as in sewers. It also occurs in gases, natural gas and in well waters. H2S may be produced during the biological process when biological substrates are used to expedite the remediation process.

Chemical Properties

Hydrogen sulfide is heavier than air and may travel along the ground. It collects in low-lying and enclosed, poorly-ventilated areas such as basements, manholes, sewer lines, and underground telephone vaults. For work within confined spaces, use appropriate procedures for identifying hazards, monitoring and entering confined spaces (see Confined Space Entry section of this Handbook or the project safety plan). Additionally, H2S is a highly flammable gas and gas/air mixtures can be explosive. It may travel to sources of ignition and flash back. If ignited, the gas burns to produce toxic vapors and gases, such as sulfur dioxide.

Routes of Exposure and Exposure Limit

The primary route of exposure to H2S is inhalation, and the gas is rapidly absorbed by the lungs. Absorption through the skin is minimal. People can smell the "rotten egg" odor of H2S at low concentrations in air. However, with continuous low-level exposure, or at high concentrations, a person loses his/her ability to smell the gas even though it is still present; this is called olfactory fatigue. This can happen very rapidly and at high concentrations, the ability to smell the gas can be lost instantaneously. Therefore, DO NOT rely on your sense of smell to indicate the continuing presence of H2S or to warn of hazardous concentrations.

About half of the population can smell H2S at concentrations as low as 0.5 parts per billion (ppb) in air, and more than 90 percent can smell it at levels of 50 ppb. At higher concentrations H2S rapidly deadens the sense of smell. For most people, this occurs at approximately 150 ppm.

The American Conference of Governmental Industrial Hygienists (ACGIH) 8-hr time-weighted average (TWA) exposure limit for H2S is 1 ppm; the 15-minute short term exposure limit (STEL) is 5 ppm.

The Immediately Dangerous to Life or Health (IDLH) in air is 100 ppm. Exposure to 500 ppm can be fatal in a few breaths. Exposure to 1000 ppm is fatal.

Effects on the Body

Hydrogen sulfide is both an irritant and a chemical asphyxiant with effects on both oxygen utilization and the central nervous system. Its health effects can vary depending on the level and duration of exposure. Low concentrations irritate the eyes, nose, throat and respiratory system (e.g., burning/tearing of eyes, cough, shortness of breath). Asthmatics may experience breathing difficulties. The effects can be delayed for several hours, or sometimes several days, when working in low-level concentrations. Repeated or prolonged exposures may cause eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss.

Moderate concentrations can cause more severe eye and respiratory irritation (including coughing, difficulty breathing, and accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability.

High concentrations can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death.

H₂S as a Project Hazard

Elevated levels of H2S have not been reported during normal drilling activities, but experience has shown that high levels of H2S may be present in the well space and in the breathing zone following the injection of emulsified oil, once the biological process has had time to progress. Engineering controls shall be considered to bring the concentrations of H2S down to an acceptable level in the breathing zone, followed by administrative controls, and respiratory protection.

All employees will receive orientation on the emergency contingency plan for the specific actions to follow when there is an H₂S release from equipment, fire involving H₂S, or medical emergency involving exposure to H₂S.

Air Monitoring

Follow the air monitoring action levels in the project safety plan. If elevated levels of H2S are encountered, first implement engineering controls to reduce exposures to allowable levels. If that is not possible, then an upgrade in PPE may be required; refer to the PPE section of the project safety plan.

8.32 Lead

(Reference CH2M HILL SOP HSE-508, Lead)

CH2M HILL is required to control employee exposure to lead when exposures are at or above 30 μ g/m³ by implementing a program that meets the requirements of the OSHA Lead standard, 29 CFR 1910.1025 and 29 CFR 1926.62. The elements of the CH2M HILL lead program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of lead and control measures (includes project-specific training and the computerbased training on CH2M HILL's Virtual Office, *Lead Exposure Training*); and
- Record keeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person; and
- Review the fact sheet included as an attachment to the SOP.

8.33 Lockout/Tagout Activities

(Reference CH2M HILL SOP HSE-310, Lockout and Tagout)

Lockout/tagout (LO/TO) shall be performed whenever service or maintenance is necessary on equipment that could cause injury to personnel from the unexpected equipment energizing or start-up or unexpected release of stored energy. Energy sources requiring lockout/tagout may include electrical, pneumatic, kinetic, and potential.

If work on energized electrical systems is necessary—contact the RHSM. Specific training and procedures are required to be followed before any work on energized electrical systems can be performed and are NOT covered in this section. Energized electrical work is defined as work performed **on or near** energized electrical systems or equipment with exposed components operating at 50 volts or greater. Working near energized live parts is any activity inside a Limited Approach Boundary (anywhere from 3.5 feet to 24 feet [1 meter 7.3 meters] depending on voltage). Examples of energized electrical work include using a voltmeter to troubleshoot electrical systems and changing out controllers.

When lockout/tagout is necessary to perform maintenance/repair of a system, all the requirements of SOP HSE-310, Lockout and Tagout, shall be met including the following bulleted items:

- When CH2M HILL controls the work, CH2M HILL must verify that subcontractors affected by the unexpected operation of equipment develop a written lockout/tagout program, provide training on lockout/tagout procedures and coordinate its program with other affected subcontractors. This may include compliance with the owner or facility lockout/tagout program.
- When CH2M HILL personnel are affected by the unexpected operation of equipment they must complete the electrical safety awareness module on the VO. Authorized personnel shall inform the affected personnel of the LO/TO. Affected personnel shall not tamper with LO/TO devices.
- Standard lockout/tagout procedures include the following six steps: 1) notify all personnel in the affected area of the lockout/tagout, 2) shut down the equipment using normal operating controls, 3) isolate all energy sources, 4) apply individual lock and tag to each energy isolating device, 5) relieve or restrain all potentially hazardous stored or residual energy, and 6) verify that isolation and deenergization of the equipment has been accomplished. Once verified that the equipment is at the zero energy state, work may begin.
- All safe guards must be put back in place, all affected personnel notified that lockout has been removed and controls positioned in the safe mode prior to lockout removal. Only the individual who applied the lock and tag may remove them.
- CH2M HILL authorized employees shall complete the LO/TO training module on the VO and either the electrical safety training module on the VO or 10-hour construction training. The authorized employee must also be trained and qualified on the system they are working on (e.g., qualified electrician for working on electrical components of a system).
- When equipment-specific LO/TO procedures are not available or when existing procedures are determined to be insufficient, CH2M HILL authorized employees shall also complete the Equipment-Specific LO/TO Procedure Development Form, provided as an attachment to the SOP, to create an equipment-specific lockout/tagout procedure.

8.34 Avoidance of Munitions and Explosives of Concern (MEC) and/or Materials Potentially Presenting an Explosive Hazard (MPPEH)

(Reference CH2M HILL, SOP HSE-610, Explosives Usage and Munitions Response)

If work will be conducted on a government/military facility or ex-government/military facility; area currently or previously used as a range; or if military munitions, MEC, or material potentially presenting an explosive hazard COPYRIGHT 2015 BY CH2M HILL. THE INFORMATION IN THIS DOCUMENT IS PROPRIETARY."

(MPPEH) are associated with the scope of work or location immediately contact the CH2M HILL Central Point of Contact for Explosives Usage and Munitions Response. The following will be required prior to any field work:

- Setting up a conference call with all required personnel to conduct a basic safety risk assessment over the phone.
- Providing written directions detailing job-specific requirements and what actions to take to ensure safety during the work.
- "3R Training" will be required for all affected project personnel. This training teaches personnel to Recognize, Retreat, and Report.

8.35 Marijuana Cultivation Sites

Marijuana grow sites are illegal on public lands, but are becoming more common. These sites may be encountered when working in undeveloped or "back country" areas. These sites pose risks to workers, the public, and the environment and are most often associated with organized crime. The potential for violent confrontations is high.

Grow sites have been discovered in California forest areas including Shasta Trinity National Forest other national forest areas including San Bernardino, Los Padres, and Angeles.

Most marijuana grow sites have someone always watching the site. Even unattended sites pose a significant risk. Recognize the signs of marijuana cultivation sites, and if you think you are near one, be quiet and leave the area immediately.

How to recognize a cultivation site:

- Sometimes marijuana smells like a skunk on hot days.
- Hoses or drip lines (made of black or white PVC piping or rubber hose) located in unusual or unexpected places.
- Discarded containers of herbicides, pesticides or other chemicals. A variety of chemicals for pest and animal control, including chemicals that may be so hazardous they are illegal in the United States are sometimes encountered.
- A well-used trail where there shouldn't be one.
- People standing along roads without vehicles present, or in areas where loitering appears unusual.
- Grow sites are usually found in isolated locations, in rough steep terrain. Look for signs of cultivation, cleared vegetation, soil disturbance.
- Food cached near trailheads or alongside roads.
- Sights or sounds of human activity in remote forest areas.
- Camps containing cooking and sleeping areas with food, fertilizer, weapons, garbage, rat poison, and/or dead animals.
- Small propane bottles, used to avoid the detection of wood smoke.
- Individuals armed with rifles outside of hunting season.
- Paper cups, chicken wire or plastic sheets used for starting and protecting plants.

As soon as you become aware that you have come upon a cultivation site, leave the way you came in immediately and make as little noise as possible. Never engage the growers as these are extremely dangerous people. If you can identify a landmark or it is helpful for authorities, but put your own safety first. The growers may be present and may or may not know that you have found their grow site. Get to a safe place and report as much detail about the location and incident as you can recall to authorities. Ensure you contact the RHSM and Project Manager as soon as possible. Other precautions to take include:

- Check with local law enforcement officers to see whether they know of any dangers or concerns in the area where you will be working.
- Establish and follow check-in and checkout procedures every day.
- Make sure your supervisor and the dispatch office know where you will be working.
- If necessary, agree on a phrase that you would use to let your co-workers (SC, RHSM, or PM) know you are in danger and need law enforcement assistance immediately at your last known location.
- Make sure you have a working communication device.
- Use the buddy system. Work in pairs.
- Park your vehicle so it's pointing in the direction of escape.

8.36 Methane (as a Product of Injection Activities)

Methane is a colorless, odorless gas with a wide distribution in nature. Methane is created when organic matter decomposes (rots) without any oxygen present ("anaerobic" decomposition) and is common in landfills, marshes, septic systems and sewers.

Methane may be produced as a by-product of the biological process when biological additives are used in a remediation process (such as when emulsified oil is injected to enhance dechlorination of contaminated groundwater).

Experience has shown that methane may be present in the well space following the injection of emulsified oil, once the biological process has had time to progress. This needs to be considered when returning to collect ground water samples. Although methane degrades Engineering controls shall be considered to bring the concentrations of methane down to an acceptable level in the breathing zone.

Methane is a "simple asphyxiant," which means that it can displace available oxygen. Methane is combustible and mixtures of methane with air are explosive within the range 5-15 percent by volume of methane (the lower and upper explosive limits). At room temperature, methane is lighter than air, so in an outdoor environment, it tends to dissipate.

Methane is not toxic when inhaled, but it can produce suffocation by reducing the concentration of oxygen inhaled. When exposed to concentrations high enough to displace oxygen, you may experience dizziness, deeper breathing, possible nausea and eventual unconsciousness.

The primary danger is from fire and explosion, so ensure that you work in a well-ventilated area, and that there is no source of ignition present. Use spark-proof tools and intrinsically safe equipment, if necessary. If working in a confined space, make sure that appropriate controls are in place and follow an approved permit-required confined space entry plan.

8.37 Methane (as Landfill Gas or Shale Formations)

Landfill gas is normally made up of 50 percent methane and 50 percent carbon dioxide

Shale formations can produce methane that has the potential to be released during drilling or groundwater sampling.

Other constituents have been found in the landfill gas. These may include hydrogen sulfide, tetrachloroethene, ethyl benzene, toluene, and xylenes.

- Continuous monitoring is required when performing intrusive activities (e.g., excavation, drilling) in a methane area. This includes refuse and any cover material.
- Monitoring will be conducted with oxygen/combustible gas meters.

- All instruments will be calibrated according to manufacturer's specifications. Instruments will be calibrated at the frequency specified by the manufacturer.
- Ventilation is the primary control to reduce the fire potential from methane. The action required for ventilation include:
- Natural Ventilation If the wind speed across the bore hole or sampling apparatus is over 5 mph (8 kph) then natural ventilation is sufficient. Equipment and personnel must be located upwind of the potential methane source to prevent any ignition source from contacting methane in air.
- Forced Ventilation If the wind speed across the bore hole or sampling apparatus is less than 5 mph (8 kph) then forced ventilation is required. Large air movers are preferable but standard ventilation fans may be used if the air flow is directed to the bore hole or the location in the sampling apparatus where the methane first encounters open air.

8.38 Methylene Chloride

(Reference CH2M HILL SOP HSE-509, *Methylene Chloride*)

Methylene chloride has a faint, sweet odor which is not noticeable at dangerous concentrations. Methylene chloride is shipped as liquefied compressed gas and will cause frostbite on contact.

CH2M HILL is required to control employee workplace exposure to methylene chloride when personal exposures are at or above 12.5 parts per million (ppm) as an 8-hour time-weighted average (TWA) or above 125 ppm short-term exposure limit (STEL) by implementing a program that meets the requirements of the OSHA Methylene Chloride standard, 29 *Code of Federal Regulations* (CFR) 1910.1052. The elements of the CH2M HILL methylene chloride program include the following:

- Exposure monitoring;
- Methods of control, including personal protective equipment (PPE) and respirators;
- Medical surveillance;
- Training on hazards of methylene chloride and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Methylene Chloride*) and;
- Recordkeeping requirements.

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met;
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas;
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person;
- Appropriate air-supplied respirators must be used when methylene chloride exposures exceed PEL or STEL;
- Air supplied to respirators must meet Grade D breathing air requirements; and
- Review the fact sheet included as an attachment to the SOP.

8.39 Naturally Occurring Radiation Materials (NORM)

Naturally Occurring Radiation Materials (NORM) is found in the earth's crust, soil, plants and many living organisms. The geologic formations that contain oil and gas deposits also contain NORM, commonly consisting of the elements of uranium, radium, thorium and their associated decay products. If present, these radio nuclides

dissolve in water and can be bound into the scale deposited in production equipment handling produced water. Radon gas follows the propane/ethane streams of produced (natural) gas and the radon gas byproducts (radon daughters) can be deposited on the inside surfaces of gas handling equipment. Land can be contaminated with NORM from descaling operations, contaminated sludges, and/or residual from produced water.

Equipment that can contain NORM-contaminated scale includes equipment associated with the separators (separate gas from the oil and water) and heater treaters (divide the oil and water phases) such as flowlines, pumps, valves, and piping (especially transition pieces such as elbows and reducer) and filters.

Gas processing equipment can also be contaminated with NORM (radon daughters). This contamination, unlike scales, can be in the form of an invisible film inside gas equipment and can only be detected by internal surveying with appropriate instrumentation.

Natural gas liquid equipment can also be contaminated by radon in the gas. Sludges accumulated in this equipment may contain the heavy metal radon daughters that have attached to dust and other particles that become part of the sludge.

While NORM has generally been associated with exploration and production activities, there is some industry experience to indicate that some refinery process equipment can also be contaminated with NORM, including natural gas stream equipment, crude tank bottoms, desalters, overhead atmospheric pipestill equipment, and exchanger deposits/sludge.

Hazards of NORM

NORM generally does not present an external radiation (Gamma) hazard to employees working around closed process equipment. This is particularly the case with NORM associated with scale inside equipment handling production water due to attenuation by the scale and steel pipe wall. Recent field experience, however, indicates that some in-service gas processing equipment, particularly valves, elbows, or transition piping pieces, may have fairly high external Gamma radiation levels. If gas-processing equipment is out of service for more than 4 hours, external Gamma measurements will not detect internal accumulation of the radon daughters.

Work procedures are recommended when maintaining NORM contaminated equipment such as pipelines, filters, pumps, lines, sludge or wellhead equipment. The exposure risk is highest when grinding, cutting, polishing, or performing other work that may generate dust. These dusts present inhalation hazards that result in internal exposures to radioactive material.

- Radium, radon, and their decay products are radioactive elements of concern in petroleum production and gas processing. Exposure may occur when contaminated dusts and sludge are inhaled or ingested (internal exposure) or when radiation from surrounding equipment strikes the body (external exposure).
- Radium is found in most oil and gas fields in the world in varying concentrations. There is potential to find radium in significant amounts in almost all types of equipment. Radon is found in most natural gas deposits in the world.
- Radon itself does not present a health hazard because it is not easily absorbed into the body and is quickly cleared when absorbed.
- Radon's radioactive breakdown products, called radon "daughters," may be hazardous. Radon naturally breaks down into radioactive metals before becoming non-radioactive lead.
- Radon daughters may be inhaled or ingested when attached to scale or dust generated during equipment inspection and repair. Radon daughter overexposure has been associated with an increased risk of lung cancer.

NORM Hazard Control Measures

• For operations where NORM is a potential hazard, a qualified individual (s) will be assigned for implementing radiological protection of employees, members of the public, and the environment.

- Surveys and monitoring must be conducted to evaluate the potential radiological hazards. The surveys must include measurements for radiation levels based on the concentrations or quantities of radioactive material, along with any other measurements or evaluations necessary to characterize the potential radiological hazards that could be present.
- Equipment contaminated with NORM must be labeled.
- Gas processing equipment should be opened to allow gas to escape, and allowed to stand idle for at least 4 hours prior to any entry.
- Water washing of any equipment prior to entry is recommended when practical.
- Personal protective equipment (PPE) must be selected based on the hazards (both radiological and non-radiological) work activities to be conducted, and the contamination levels in the work area,
 - Level D PPE must be worn to minimize skin contact with NORM such as gloves and appropriate body protection. Disposable clothing such as TYVEK is preferred since NORM contaminated clothing should be laundered.
 - Level C PPE using full-face air-purifying respirator with high efficiency particulate air (HEPA filters) must be worn if dust exposure is expected.
- Do not sand, grind, cut, or weld on surfaces contaminated with NORM without appropriate cleaning. Equipment should be resurveyed after cleaning prior to these activities.
- NORM-contaminated equipment or material should not be shipped offsite for repair or disposal without first contacting the designated NORM coordinator (may be the RHSM and/or REM)

8.40 PCB/Ballast Handling

Fluorescent lighting used in many older buildings use ballast resistors that contain polychlorinated biphenyl (PCB) oil. PCB is colorless to light-colored, viscous liquid with a mild, hydrocarbon odor.

PCB has been found to cause, irritation eyes; chloracne; liver damage; reproductive effects; and has shown to cause cancer in lab animals.

When work requires the handling or removal of fluorescent ballast resistors, extra care and attention needs to be taken. While ballasts are usually well sealed, it is not uncommon to find a ballast resistor that has leaked. Below are the hazard controls and safe work practices to be followed when PCBs are present.

- A survey must be made to determine whether ballast resistors contain PCB fill.
- Leaking resistors must be identified and handled with appropriated PPE.
- Exposure Routes are inhalation, skin absorption, ingestion, skin and/or eye contact
- Prevent skin contact by using chemical resistant gloves, wear eye protection, and thoroughly wash hands before eating or smoking.
- Ensure eyewash is available.
- In the event of exposure, follow the following First Aid procedures: Eyes: Irrigate immediately
 Skin: Soap wash immediately
 Ingestion: Seek medical attention immediately
- Dispose of PCB ballast resistors in accordance with Federal, State and Local environmental regulations.

8.41 Portable Generator Hazards

(Reference CH2M HILL SOP HSE-206, Electrical Safety)

- Portable generators are useful when temporary or remote electric power is needed, but they also can be hazardous. The primary hazards to avoid when using a generator are carbon monoxide (CO) poisoning from the toxic engine exhaust, electric shock or electrocution, and fire.
- NEVER use a generator indoors or in similar enclosed or partially-enclosed spaces. Generators can produce high levels of carbon monoxide (CO) very quickly. When you use a portable generator, remember that you cannot smell or see CO. Even if you can't smell exhaust fumes, you may still be exposed to CO.
- If you start to feel sick, dizzy, or weak while using a generator, get to fresh air RIGHT AWAY. DO NOT DELAY. The CO from generators can rapidly lead to full incapacitation and death.
- If you experience serious symptoms, get medical attention immediately. Inform project staff that CO poisoning is suspected. If you experienced symptoms while indoors have someone call the fire department to determine when it is safe to re-enter the building.
- Follow the instructions that come with your generator. Locate the unit outdoors and away from doors, windows, and vents that could allow CO to come indoors.
- Generators rated greater than 5 kilowatts that are not vehicle- mounted need to be grounded in accordance with regulatory and manufacturer requirements. Always refer to the manufacturer grounding requirements for any generator used on site.
- Keep the generator dry and do not use in rain or wet conditions. To protect from moisture, operate it on a dry surface under an open, canopy-like structure. Dry your hands if wet before touching the generator.
- Plug appliances directly into the generator. Or, use a heavy duty, outdoor-rated extension cord that is rated (in watts or amps) at least equal to the sum of the connected appliance loads. Check that the entire cord is free of cuts or tears and that the plug has all three prongs, especially a grounding pin.
- Most generators come with Ground Fault Circuit Interrupters (GFCI). Test the GFCIs daily to determine whether they are working
- If the generator is not equipped with GFCI protected circuits plug a portable GFCI into the generator and plug appliances, tools and lights into the portable GFCI.
- Never store fuel near the generator or near any sources of ignition.
- Before refueling the generator, turn it off and let it cool down. Gasoline spilled on hot engine parts could ignite.

8.42 Powder-Actuated Tools

(Reference CH2M HILL SOP HSE-210, Hand and Power Tools)

Below are the hazard controls and safe work practices to follow when working around or using powder-actuated tools. Ensure the requirements in the referenced SOP are followed.

- Only trained personnel are permitted to operate powder-actuated tools.
- Inspect and test powder-actuated tools each day before they are loaded per manufacturer's instruction. Remove from service any tool that is not in proper working order.
- Wear appropriate personal protective equipment (eye, face, and hearing protection) when using powderactuated tools.
- Never point powder-actuated tools at other workers, whether empty or loaded. Tools shall not be loaded until just before use. Never leave loaded tools unattended.

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- Do not drive fasteners into very hard or brittle materials such as, cast iron, glazed tile, surface-hardened steel, glass block, live rock, face brick, or hollow tile.
- Avoid driving fasteners into easily penetrable materials unless backing is provided. Pins or fasteners can otherwise become flying missiles when they pass right through such materials.
- Use powder-actuated tools with the manufacturer's specified guard, shield, or other attachment.
- Do not use powder-actuated tools in explosive or flammable atmospheres.

8.43 Pressure Line/Vessel Systems

- Operate and maintain pressure vessels, pumps and hosing in accordance with the manufacturer's recommendations.
- Do not exceed the rated pressure of the vessels and hosing of the system.
- The system must be provided with a pressure relief valve/controller that safely reduces the system pressure to within the system rated pressure.
- The pressure relief valve must be rated at no more than 110 percent the rated pressure of the system and must be tested at regular intervals.
- Each vessel must be equipped with a functioning pressure gauge to monitor pressure.

8.44 Pressure Washing Operations

Below are the hazard controls and safe work practices to follow when working around or performing pressure washing.

- Only trained, authorized personnel may operate the high-pressure washer.
- Follow manufacturer's safety and operating instructions.
- Inspect pressure washer before use and confirm deadman trigger is fully operational
- The wand must always be pointed at the work area.
- The trigger should never be tied down
- Never point the wand at yourself or another worker.
- The wand must be at least 42 inches (1.1 meter) from the trigger to the tip and utilize greater than 10 degree tips.
- The operator must maintain good footing.
- Non-operators must remain a safe distance from the operator.
- No unauthorized attachment may be made to the unit.
- Do not modify the wand.
- All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- Polycoated Tyvek or equivalent, 16-inch-high steel-toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn, at a minimum.

8.45 Process Safety Management

(Reference CH2M HILL SOP HSE-213, Process Safety Management)

 All CH2M HILL projects require a systematic evaluation of processes to prevent, or minimize the consequences of, catastrophic releases of toxic, reactive, flammable, or explosive chemicals at or above the

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specified threshold quantities listed in Appendix A, List of Highly Hazardous Chemicals, Toxics, and Reactives in OSHA Standard 29 CFR 1910.119, Process Safety Management.

- A Process Hazard Analysis (PHA) is required of all processes covered by PSM.
- Operating procedures shall be developed and implemented that provide clear operating instructions consistent with the process safety information.
- Contractors, whether considered to be CH2M HILL or a subcontractor of CH2M HILL, performing maintenance or repair, turnaround, major renovation, or specialty work on or adjacent to a covered process shall be informed by the client of the known potential fire, explosion, and toxic release hazards related to the contractor work and the provisions of the emergency action plan.
- CH2M HILL projects shall develop and implement the written procedure requirements to maintain the mechanical integrity of pressure vessels, storage tanks, piping systems, relief and vent systems, emergency shutdown systems, and controls and pumps process systems.
- A hot work permit shall be completed for any CH2M HILL work involving welding, cutting, brazing, or similar flame- or spark-producing operations conducted near a covered process.
- Written procedures shall be developed, updated, and implemented to manage changes in chemicals, technology, equipment, and facilities.
- An incident report form (IRF) shall be completed within 24 hours of a PSM-related incident. Incidents involving a release of highly hazardous chemicals shall be reported following the Serious Incident Reporting section of SOP HSE-111.
- An investigation shall be initiated as soon as possible, but no later than 48 hours following an incident that resulted in, or could reasonably have resulted in, a catastrophic release of a highly hazardous chemical.
- An emergency action plan shall be developed and implemented for the entire plant, including procedures for handling small releases.
- A facility or process audit shall be performed every three years to certify compliance with the PSM standard.
- All information regarding compliance with PSM requirements shall be made available to affected personnel without regard to possible trade secret status.
- CH2M HILL employees shall be trained before operating a newly assigned process or when involved in maintaining equipment. Refresher training shall be provided at least every three years and more often if necessary to assure the employee understands and adheres to the current operating procedures of the process.

8.46 Radar Hazards

Airports and all branches of the military use radar of significant power for buildings, towers, aircraft, ships, armor vehicles, and installations in general. Radar devices may emit harmful microwave radiation emissions. Microwave radiation is absorbed by the body and dissipated in the tissue as heat.

The penetration ability of the radiation depends on the wavelength. Microwave wavelengths of 25-200 centimeters have the ability to reach the internal organs with potentially damaging effects. Wavelengths less than 25 centimeters are absorbed and dissipated by the skin and the human body is thought to be transparent to microwave wavelengths greater than 200 centimeters. The health effects of microwave radiation include deep burns and thermal damage to any organ or organ system with low blood flow, most notably the lenses of the eyes. If adequate time has elapsed between exposures, the repair mechanisms of the lens seem to limit damage. Microwave radiation cannot be seen and its effects cannot be felt until serious damage has already occurred.

The OSHA exposure limit is 10 milliwatts per square centimeter (10 mW/cm²) averaged over any 6-minute period.

Warning signs must be posted in areas where potentially damaging microwave radiation exists.

The prevention method for microwave radiation exposure is to not be in the path of radar or other microwave emitting devices by either ensuring that the device is not operating or ensuring that there is sufficient shielding between you and the microwave source.

8.47 Rail Road Safety

Careful observation of railroad safety requirements is essential and is governed by the Federal Railroad Administration (FRA). For railroads involving Union Pacific Railroads (UPRR), refer to the "Minimum Safety Requirements for Engineering Department Contractors," of the E&NBG HSE SharePoint site which addresses training, minimum PPE, and safety requirements.

Permission to enter railroad property must be obtained from the local railroad. Working alone is not anticipated for this work. Contact the RHSM if working alone in the vicinity of railroads becomes necessary. Additional hazard controls will be evaluated by the RHSM and incorporated into the project safety plan.

If required by the client or railroad, all employees must participate in and comply with any job briefings conducted by the railroad's employee in charge (EIC). During these briefings, the railroad's EIC will specify safe work procedures, the potential hazards of the job, and emergency response procedures.

The following PPE must be worn when working around trains and rail-yards.

- Reflective/high-visibility safety vests (orange or green-yellow);
- ANSI Z87.1-approved safety glasses shall be worn to protect from flying debris;
- ANSI-approved hard hat;
- Safety-toed boots;
- Hearing protection is required when employees are within 100 feet of locomotive or roadway/work equipment; 15 feet of power operated tools 150 feet of jet blowers or pile drivers 150 feet of retarders in use (when within 10 feet, employees must wear dual ear protection – plugs and muffs); and
- Any other PPE as required by the PPE section of the project safety plan.

Other general safety requirements include:

- Any work conducted within 25 feet of active tracks must first be approved by the client and any EIC requirements addressed (preferably in an AHA). Training (i.e., On-track Railroad Safety Training) is required by the Federal Railroad Administration in these instances. Coordinate this training with the RHSM or Safety Program Assistant (SPA).
- Attend client's safety training courses, as required, and carry or maintain proof of training as required by the client;
- Always pay attention to moving trains never assume they are looking out for you;
- Work as far from traveled way as possible to avoid creating confusion for trains;
- Use the "buddy system" when work does not face the direction in which trains are coming from.
- The railroad must be promptly notified of any reportable injury;
- The railroad must be promptly notified of any damage to railroad property;
- All waste must be properly disposed of. No fires are permitted;
- All contractor's vehicles stop at all railroad crossings to ascertain the way is clear;

- Always be on alert for moving equipment in either direction on the tracks. Do not stop or walk on the top of rail, frog, switches, guard rails, or other track components.
- When walking around a standing rail car, stay at least 20 feet behind it. Do not walk between rail cars unless there is a 50 feet clearance between cars. Do not sit on, lie under, or cross between cars.
- No tools or materials are to be left close to the track when trains are passing.

8.48 Rigging

(Reference CH2M HILL SOP HSE-316, Rigging)

Below are the hazard controls and safe work practices to follow when personnel are overseeing or performing rigging. Ensure the requirements in the referenced SOP are followed.

8.48.1 General

- All rigging equipment shall be used only for its intended purpose, inspected by a competent person prior to use, and shall not be loaded in excess of its capacity rating. Defective rigging shall be removed from service.
- When CH2M HILL is in control of rigging operations, CH2M HILL shall provide a rigging competent person that will inspect, maintain oversee all rigging operations. The competent person shall use the appropriate rigging inspection log form to inspect wire rope, synthetic slings and/or shackles.
- Tag lines shall be attached to every load being lifted by a crane.
- Rigging equipment shall be protected from flame cutting and electric welding operations, and or contact avoided with solvents and chemicals.
- Rigging equipment, when not in use, shall be stored in an area free from damage caused by environmental elements, hazardous substances, and other factors that may compromise equipment integrity and performance.
- No modification or addition, which that could affect the capacity and or safe operation of the equipment, shall be made without the manufacturer's written approval.
- Rigging equipment shall not be shortened with knots, bolts or other makeshift devices.
- All rigging equipment shall be load tested at least annually by a competent person and documented.
- Special hoisting devices, slings, chokers, hooks, clamps, or other lifting accessories shall be marked to indicate the safe working loads and shall be proof -tested prior to initial use to 125 percent of their rated load. Vendors or suppliers will provide documentation of proof testing documentation.

8.48.2 Equipment

- Protruding end strands of wire rope shall be covered or blunted.
- Wire rope shall not be used, if in any length of eight diameters, the number of total number of visible broken wires exceeds 10 percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect.
- When inspecting the end fittings of wire rope slings, if more than one wire in a lay is broken in the fitting, do not use the sling.
- Synthetic web slings shall be immediately removed from service if any of the following conditions are present:
 - acid or caustic burns; melting or charring of any part of the sling
 - surface; snags, punctures, tears or cuts; broken or worn stitches; distortion of fittings;
 - discoloration of or rotting; red warning line showing.

- Never use makeshift hooks, links or other fasteners. Job or shop hooks and links, or makeshift fasteners, formed from bolts, rods, etc., or other such attachments, shall not be used.
- Alloy steel chains shall have permanently affixed identification stating size, grade, rated capacity and reach.
- Shackles and hooks shall be constructed of forged alloy steel with the identifiable load rating on the shackle or hook.

8.48.3 Rigging Use

- Rigging shall not be pulled from under a load when the load is resting on the rigging.
- Place sling(s) in center bowl of hook.
- When attaching slings to the load hoist hook, corners and sharp edges should be "packed" to prevent cutting or damaging the rope or slings.
- Never use nylon, polyester, or polypropylene web slings, or web slings with aluminum fittings shall not be used where fumes, vapors, sprays, mists or liquids of acids, caustics or phenolics are present.
- Natural and synthetic fiber rope slings, except for wet frozen slings, may be used in a temperature range form from minus 20° F to plus 180° F without decreasing the working load limit. For operations outside this temperature range, and for wet frozen slings, the sling manufacturer's recommendations shall be followed.
- When used for eye splices, the U-bolt shall be installed so that the "U" section is in contact with the dead end of the rope.

8.49 Scaffolds

(Reference CH2M HILL SOP HSE-311, Scaffolds)

Below are the hazard controls and safe work practices to follow when personnel or subcontractor personnel are using scaffolds. Ensure the requirements in the referenced SOP are followed.

8.49.1 Working from Scaffolds

- All scaffolds must be designed by a qualified person and installed under the supervision of a competent person.
- Do not access scaffolds until the competent person has completed the work shift inspection and has authorized access.
- Follow all requirements established by the competent person or as identified on the scaffold tag.
- Do not access scaffolds until authorized by the competent person.
- Do not access scaffolds that are damaged or unstable at any time and for any reason.
- Only access scaffolds by means of a ladder, stair tower, ladder stand, ramp, integral prefabricated scaffold access, or other equivalent safe means of access. Scaffold cross-bracing shall not be used to access scaffold platforms.
- Remain within the scaffold guardrail system when provided. Leaning over or stepping across a guardrail system is not permitted.
- Use personal fall arrest systems when required by the competent person and when working from suspension scaffolds or boatswains' chairs.
- Do not stand on objects (boxes, buckets, bricks, blocks, etc.) or ladders on top of scaffold platforms to increase working height unless the platform covers the entire floor area of the room.

- Do not work on scaffolds covered with snow, ice, or other slippery material or work on scaffolds during storms or high winds unless personal fall arrest systems or wind screens are provided and the competent person determines it is safe to remain on the scaffold.
- Do not overload scaffold planks over their rated weight bearing capacity. When feasible, place loads directly over the scaffolds vertical weight bearing structures.

8.49.2 Supported Scaffolds

This section covers the erection, use, and dismantling of supported scaffolds. Supported scaffolds consist of one or more platforms supported by outrigger beams, brackets, poles, legs, uprights, posts, frames, or similar rigid support. Supported scaffolds include frame, fabricated frame, tube and coupler, pole, bricklayer's, and step platform. The common requirements for all supported scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- CH2M HILL staff erecting, dismantling, or working on scaffolds must complete the CH2M HILL 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A CH2M HILL scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- Stationary scaffolds over 125 feet (38.1 meters) in height and rolling scaffolds over 60 feet (18.3 meters) in height must be designed by a professional engineer.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.
- The site must be inspected to determine ground conditions, strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Supported scaffolds must be set on base plates, mudsills, or other adequate firm foundation.
- Frame spacing and mudsill size can only be determined after the total loads to be imposed on the scaffold and the strength of the supporting soil or structure are calculated and considered. This analysis must be done by a qualified person.
- Base plates or screwjacks with base plates must be in firm contact with both the sills and the legs of the scaffolding. Compensate for uneven ground with screwjacks with base plates. DO NOT USE unstable objects such as blocks, loose bricks, etc.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).

- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.49.3 Suspended Scaffolding

Suspension scaffolds consist of one or more platforms suspended by ropes or other non-rigid means from an overhead structure(s). The common requirements for suspended scaffolds are addressed here; the competent person shall ensure scaffold type specific requirements are included as applicable.

- CH2M HILL staff erecting, dismantling, or working on scaffolds must complete the CH2M HILL 10-Hour Construction Safety Awareness training course. Staff must also and receive project-specific scaffold training from a qualified person. Staff shall not use scaffold systems for which they have not been trained.
- A CH2M HILL scaffold competent person shall be assigned to direct and oversee the erection, dismantling, and use of scaffolds. Additionally, they must inspect scaffolds each day prior to use.
- Scaffolds shall be designed by a qualified person and shall be constructed and loaded in accordance with that design.
- A tag and permit system shall be used to inform personnel of the construction status of the scaffold. At a minimum, the system used shall inform users when a scaffold is complete and safe to be used and when a scaffold is under construction and is not ready to be used. When additional precautions are required to use the scaffold safely, for example, the use of fall protection systems, the system shall identify the precautions to be taken. The tag or permit shall be placed at each means of access to the scaffold. The competent shall be responsible for the tag and permit system.
- A daily safety briefing shall be conducted with all scaffold personnel to discuss the work planned for the day and the HSE requirements to be followed.
- Scaffolds and scaffold components must be capable of supporting, without failure, their own weight and at least 4 times their maximum intended load.
- The site must be inspected to determine the strength of supporting structure, and for proximity of electric power lines, overhead obstructions, wind conditions, the need for overhead protection or weather protection coverings.
- Scaffolds and scaffold components must be inspected for visible defects before each shift by a competent person, and after each occurrence that could affect a scaffold's integrity (such as being struck by a crane).
- Maintain scaffolding and materials (e.g., paint roller extensions, building material) at least 10 feet (3 meters) from overhead power lines for voltages of 50 kV or less, and 10 feet (3 meters) plus 0.4 inch (1.0 cm) for every 1 kV over 50 kV.
- All portable electric equipment must be protected by ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program.

8.49.4 Fall Protection on Suspended Scaffolds

- Each employee on a multi-point or two-point adjustable suspension scaffold must be protected by both a guardrail system and a personal fall arrest system.
- Personal fall-arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member.
- Guardrail systems must be installed along all open sides and ends of platforms, and must be in place before the scaffold is released for use by employees other than erection/dismantling crews.

8.50 Stairways and Ladders

(Reference CH2M HILL SOP HSE-214, Stairways and Ladders)

Below are the hazard controls and safe work practices to follow when using stairways and ladders. Ensure the requirements in the referenced SOP are followed.

- Stairway or ladder is generally required when a break in elevation of 19 inches (48.3 cm) or greater exists.
- Personnel should avoid using both hands to carry objects while on stairways; if unavoidable, use extra precautions.
- Personnel must not use pan and skeleton metal stairs until permanent or temporary treads and landings are provided the full width and depth of each step and landing.
- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Always obey and pay attention to warning labels or stickers on the specific ladder being used.
- Ladders must be used only for the purpose for which they were designed and shall not be loaded beyond their rated capacity.
- Ladder safety training on safe use (take the Stairways and Ladders safety training module located on the VO).
- Only one person at a time shall climb on or work from an individual ladder.
- User must face the ladder when climbing; keep belt buckle between side rails.
- Ladders shall not be moved, shifted, or extended while in use.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Personnel climbing ladders shall face the ladder and maintain 3 points of contact with the ladder.
- Portable ladders must extend at least 3 feet (91.5 cm) above landing surface.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top or straddle a stepladder.
- Fixed ladders \geq 24 feet (7.3 meters) in height must be provided with fall protection devices.
- Fall protection should be considered when working from extension, straight, or fixed ladders greater than six feet (1.8 meters) from lower levels and both hands are needed to perform the work, or when reaching or working outside of the plane of ladder side rails.

8.51 Steel Erection

(Reference CH2M HILL SOP HSE-312, Steel Erection)

Below are the hazard controls and safe work practices to follow when working around or performing steel erection activities. Ensure the requirements in the referenced SOP are followed.

- Protruding reinforcing steel (rebar), onto which personnel could fall, must be guarded to eliminate the hazard of impalement.
- Structural steel loads shall not be released from the hoisting line until the members are secured with at least two bolts, or the equivalent at each connection and drawn up wrench tight.
- Tag lines shall be used for controlling loads.
- Containers shall be provided for storing or carrying rivets, bolts, and drift pins, and secured against accidental displacement when aloft.
- Air line hose sections shall be secured together, except when quick disconnect couplers are used to join sections.
- Impact wrenches used for bolting shall be provided with a locking device for retaining the socket.
- Turnbuckles shall be secured to prevent unwinding while under stress.
- Plumbing-up guys shall be removed only under the supervision of a competent person.
- Metal decking of sufficient strength shall be laid tight and secured to prevent movement.
- Provisions shall be made to secure temporary flooring against displacement. Planks shall overlap the bearing on each end by a minimum of 12 inches (30.5 cm). Wire mesh, exterior plywood, or equivalent, shall be used around columns where planks do not fit tightly.
- All unused openings in floors, temporary or permanent, shall be completely planked over or guarded.

8.52 Slips, Trips and Falls

General

- Institute and maintain good housekeeping practices.
- Designate foot traffic paths in and out of sites, when necessary, to ensure paths are kept free from slip, trip, and fall hazards or to deter personnel from taking "shortcuts" where slip, trip, hazards may be.
- Mitigate icy conditions by keeping foot traffic paths clear of ice and snow.
- Watch footing as you walk to avoid trip hazards, animal holes, or other obstacles, especially in tall grassy areas.

Muddy Conditions

- Muddy conditions present a slipping hazard. Use mats or other similar surface to work from if footing cannot be stabilized.
- Take shortened steps across muddy areas.
- Use a walking staff or other similar means to assist with balance.

Steep Slopes/Uneven Ground/Rock and Vertical Slopes

- Be aware that escarpments can slough. Avoid these areas.
- Exercise caution in relying on rocks and trees/tree stumps to support yourself many times they are loose.
- Whenever possible, switchback your way up/down steep areas, and maintain a slow pace with firm footing.
- Employees walking in ditches, swales and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls which can result in twisted or sprained ankles, knees, and backs.

- Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated coordinate with RHSM to evaluate the need for ladders or ropes to provide stability.

Snow and Ice on Walking/Working Surfaces

Housekeeping and Preparedness

- Evaluate whether the work can be postponed until site conditions improve for both our work and our subcontractors.
- Remove snow from walkways regularly and use ice-melt or sand, when necessary.
- Notify those responsible for clearing walkways and work areas when we observe a potentially hazardous location. At our project sites, be sure someone is responsible for maintaining walkways.
- Don't assume that the walk path is not slippery if it has been plowed and sanded already.
- Mark potential hazards (e.g., holes, rebar, plastic, etc.) prior to snowfall. Designate walkways that avoid such hazards.
- Avoid any ice or snow-covered location where a hazard may exist; use a vehicle rather than walking, when possible.
- If you cannot avoid the area, wear shoes or boots that provide traction on snow and ice or use YakTrax[™], ice cleats, or similar product (see links below). *Note* Additional hazards could be introduced if these types of footwear are worn inside, on stairs, etc. Be sure appropriate donning and doffing areas are established.
- Inspect your footwear before wearing it.
- Ensure that your safety plan or Activity Hazard Analysis is up to date and adequately addresses hazards of winter work environments.

How to Walk in Icy Conditions

- Give yourself sufficient time and plan your route.
- Keep your eyes on where you are stepping and GO S-L-O-W-L-Y!! This will help your reaction time to changes in traction.
- Be aware of hazards you might have missed such as black ice and ice covered by snow.
- Keep both hands free for balance --NOT in your pockets.
- When handrails are available USE THEM!
- Wear gloves to keep hands warm and readily available to hold snow-covered handrails.
- Take short steps or shuffle for stability, bend slightly, and walk flat-footed. Keep your center of gravity directly over your feet as much as possible. Keep your eyes on where you are going. Remember the "Walk like a penguin" method.
- Don't carry too much or block your line of vision.
- Be prepared to fall!

How to Fall:

Have you ever practiced falling? In the event that you slip and fall while walking in the office, to your car, or on a project site try and remember the following:

- Do not try to break your fall by sticking out your arm, elbow or wrist due to potential for fractures or ligament damage.
- Try instead to create a large surface area by either outstretching your arm and landing on your side or tucking your arm and curling to a ball and landing on your back.

<u>Getting in and out of Vehicles on icy/snowy surfaces</u> Use special care when entering and exiting vehicles:

- Use the vehicle for support
- Step out planting foot firmly on the ground
- Have hands free for support

8.53 Stream Crossing

Traversing streams present significant hazards, including drowning, hypothermia, and abrasions. When crossing streams, be sure to implement the bulleted items below.

- When walking in streams, first plan the route. Look ahead for exits should there be any difficulty during the crossing, and "read" the water for spots to avoid such as drop offs, sunken logs, and tricky currents.
- Do seek out the safest route narrow, low flow, shallow. Evaluate deeper and faster moving sections with caution. Backtracking is often dangerous or impossible once committed.
- If streams to be crossed are deeper than "knee deep", find an alternate crossing location that is less deep.
- Streams should be crossed while facing upstream, stepping side to side, and using a sturdy walking stick. When possible, wade a stream diagonally, moving downstream. Move slowly, keeping the foot on the upstream side in the lead and pointed forward. Your rear, or anchor, foot should point downstream and be at right angles to the lead foot. Move the lead foot forward about half a step, feeling for a solid hold. Next, move the anchor foot forward the same distance shuffle across so that your anchor foot never passes the lead. This way both feet are always in position to lend support. If you must turn around, do so toward the upstream direction.
- Don't attempt to cross above rocky rapids or a cascade. Step on submersed rocks with great care.
- If you are working in streams, algae covered rocks should be assumed slippery until tested. Always be alert for unstable and extremely slippery rocks.
- Rocks with green moss or attached plants offer better traction or even better, look for gravel and sand pockets among the stream boulders, which are much more stable, and use a wading staff (if not carrying one, find a suitable one nearby) to steady your balance while crossing. Use a solid wading staff instead of the collapsible type.
- Be cautious of areas where there are submerged or partially submerged trees/tree branches these can create entanglement hazards during a crossing or a "swim".
- If streams are crossed that are deeper than "crotch deep", personnel must use either ropes and/or wear chest waders.
- Choose the right waders (with RHSM/SC involvement).
- Footwear with felt-bottom soles are ideal for rocky bottom streams. The rough texture cuts through algae growing on the rocks and grips well. For very slippery conditions, consider studded felt soles or a slipover, studded sandal. However, felt soles do not provide good traction on muddy, slippery banks. Cleated soles work well for mud or sand bottom streams (a hard molded tread pattern similar to a hiking boot).
- Wear a wading belt with chest waiters to keep your waders from billowing out like a parachute; the currents will carry you and move you in ways you don't want to move.
- Never wade alone.
- If the wader fills with water, don't panic. Waders full of water weigh less in water than on land and the water inside doesn't add any weight as long as you are in the water. Also a common fear is that air trapped

in the waders will raise the feet higher than the head and force the face underwater is unfounded. Waders do streamline your legs and kicking is useless. Follow these steps if the waders fill with water:

- Don't try to take them off in the water
- In calm water, wade or swim to shore
- In fast-moving water, ride the current:
- Pull your feet up in front of you, bend your knees
- Point your feet downstream (so the feet, not the head will bounce off the rocks)
- Sculling with your hands will help direct to the nearest shallow area
- When you reach calm water, go ashore and empty your waders
- Don't waste energy in the vertical position going for the bottom. This position is virtually impossible to maintain and leads quickly to exhaustion (the major cause of drowning).
- Concentrate on getting out of the water and not saving the equipment.
- The higher the elevation you are at, the steeper the stream gradient is. This means the stream can rise quicker and return to lower flow more quickly.
- Always wait out a swollen stream if at all possible.
- If you do slip into the water and are being swept downstream, don't panic. Cold water will be a shock for 2-3 seconds. Pull your knees up, face your feet downstream and lean back, using your hands as best you can to navigate and get to the bank. Keep your head up; you don't want your head underwater banging into rocks. If you stay calm, you can reach water where you can stand up or swim to the bank.
- When walking along stream banks and not entering streams, wear work boots.

8.54 Traffic Control

(Reference CH2M HILL SOP HSE-216, Traffic Control)

The following precautions must be taken when working around traffic, and in or near an area where traffic controls have been established by a sub contractor. Ensure the requirements in the referenced SOP are followed.

- CH2MHILL employees must never perform traffic control activities for 3rd party subcontractors.
- Exercise caution when exiting traveled way or parking along street avoid sudden stops, use flashers, etc.
- Park in a manner that will allow for safe exit from vehicle, and where practicable, park vehicle so that it can serve as a barrier.
- All staff working adjacent to traveled way or within work area must wear reflective/high-visibility safety vests.
- Eye protection should be worn to protect from flying debris.
- Remain aware of factors that influence traffic related hazards and required controls sun glare, rain, wind, flash flooding, limited sight-distance, hills, curves, guardrails, width of shoulder (i.e., breakdown lane), etc.
- Always remain aware of an escape route (e.g., behind an established barrier, parked vehicle, guardrail, etc).
- Always pay attention to moving traffic never assume drivers are looking out for you.
- Work as far from traveled way as possible to avoid creating confusion for drivers.
- When workers must face away from traffic, a "buddy system" should be used, where one worker is looking towards traffic.
- When working on highway projects, obtain a copy of the contractor's traffic control plan.
- Work area should be protected by a physical barrier such as a K-rail or Jersey barrier.
- Review traffic control devices to ensure that they are adequate to protect your work area. Traffic control devices should: 1) convey a clear meaning, 2) command respect of road users, and 3) give adequate time for proper traffic response. The adequacy of these devices are dependent on limited sight distance, proximity to ramps or intersections, restrictive width, duration of job, and traffic volume, speed, and proximity.
- Either a barrier or shadow vehicle should be positioned a considerable distance ahead of the work area. The vehicle should be equipped with a flashing arrow sign and truck-mounted crash cushion (TMCC). All vehicles within 40 feet (12.2 meters) of traffic should have an orange flashing hazard light atop the vehicle.
- Except on highways, flaggers should be used when 1) two-way traffic is reduced to using one common lane,
 2) driver visibility is impaired or limited, 3) project vehicles enter or exit traffic in an unexpected manner, or
 4) the use of a flagger enhances established traffic warning systems.
- Lookouts should be used when physical barriers are not available or practical. The lookout continually watches approaching traffic for signs of erratic driver behavior and warns workers.
- Vehicles should be parked at least 40 feet (12.2 meters) away from the work zone and traffic. Minimize the amount of time that you will have your back to oncoming traffic.
- Traffic control training module on the VO shall be completed when CH2M HILL workers who work in and around roadways and who exposed to public vehicular traffic.

8.55 Utilities (underground)

An assessment for underground utilities must be conducted where there is a potential to contact underground utilities or similar subsurface obstructions during intrusive activities. Intrusive activities include excavation, trenching, drilling, hand augering, soil sampling, or similar activities.

The assessment must be conducted <u>before any intrusive subsurface activity</u> and must include at least the following elements:

- A background and records assessment of known utilities or other subsurface obstructions.
- Contacting and using the designated local utility locating service.
- Conducting an independent field survey to identify, locate, and mark potential underground utilities or subsurface obstructions. *Note: This is independent of, and in addition to, any utility survey conducted by the designated local utility locating service above.*
- A visual survey of the area to validate the chosen location.

When any of these steps identifies an underground utility within 5 feet (1.5 meters) of intrusive work, then nonaggressive means must be used to physically locate the utility before a drill rig, backhoe, excavator or other aggressive method is used.

Aggressive methods are never allowed within 2 feet of an identified high risk utility (see paragraph below).

Any deviation from these requirements must be approved by the Responsible HS Manager and the Project Manager.

Background and Records Assessment of Known Utilities

Identify any client- or location-specific permit and/or procedural requirements (e.g., dig permit or intrusive work permit) for subsurface activities. For military installations, contact the Base Civil Engineer and obtain the appropriate form to begin the clearance process.

Obtain available utility diagrams and/or as-built drawings for the facility.

Review locations of possible subsurface utilities including sanitary and storm sewers, electrical lines, water supply lines, natural gas lines, fuel tanks and lines, communication lines, lighting protection systems, etc. Note: Use caution in relying on as-built drawings as they are rarely 100 percent accurate.

Request that a facility contact with knowledge of utility locations review and approve proposed locations of intrusive work.

Designated Local Utility Locating Service

Contact your designated local utility locating service (e.g., Dig-Safe, Blue Stake, One Call) to identify and mark the location of utilities. Call 811 in the U.S. or go to www.call811.com to identify the appropriate local service group. Contacting the local utility locating service is a legal requirement in most jurisdictions. Please note that some states (e.g., Washington) require that the entity performing the intrusive work be the responsible for contacting the local service. Where subcontractors are responsible for the intrusive work, CH2M HILL personnel shall verify the subcontractor has contacted the designated local utility locating service.

Independent Field Survey (Utility Locate)

The organization conducting the intrusive work (CH2M HILL or subcontractor) shall arrange for an independent field survey to identify, locate, and mark any potential subsurface utilities in the work area. This survey is in addition to any utility survey conducted by the designated local utility locating service.

The independent field survey provider shall determine the most appropriate instrumentation/technique or combinations of instrumentation/techniques to identify subsurface utilities based on their experience and expertise, types of utilities anticipated to be present, and specific site conditions.

A CH2M HILL or subcontractor representative must be present during the independent field survey to observe the utility locate and verify that the work area and utilities have been properly identified and marked. If there is any question that the survey was not performed adequately or the individual was not qualified, then arrangements must be made to obtain a qualified utility locate service to re-survey the area. Obtain documentation of the survey and clearances in writing and signed by the party conducting the clearance. Maintain all documentation in the project file.

If the site owner (military installation or client) can provide the independent field survey, CH2M HILL or the subcontractor shall ensure that the survey includes:

- Physically walking the area to verify the work location and identify, locate, and mark underground utility locations:
- Having qualified staff available and instrumentation to conduct the locate;
- Agreeing to document the survey and clearances in writing.
- Should any of the above criteria not be met, CH2M HILL or subcontractor must arrange for an alternate independent utility locate service to perform the survey.
- The markings from utility surveys must be protected and preserved until the markings are no longer required. If the utility location markings are destroyed or removed before intrusive work commences or is completed, the PM, SC, or designee must notify the independent utility locate service or the designated local utility locating service to resurvey and remark the area.

Visual Assessment before and during Intrusive Activities

Perform a "360 degree" assessment. Walk the area and inspect for utility-related items such as valve caps, previous linear cuts, patchwork in pavement, hydrants, manholes, utility vaults, drains, and vent risers in and around the dig area.

The visual survey shall include all surface landmarks, including manholes, previous liner cuts, patchwork in pavement, pad-mounted transformers, utility poles with risers, storm sewer drains, utility vaults, and fire hydrants.

If any unanticipated items are found, conduct further research before initiating intrusive activities and implement any actions needed to avoid striking the utility or obstruction.

Subsurface Activities within 5 feet of an Underground Utility or if there is Uncertainty

When aggressive intrusive activities will be conducted within 5 feet (1.5 meters) of an underground utility or when there is uncertainty about utility locations, locations must be physically verified by non-aggressive means such as air or water knifing, hand digging, or human powered hand augering. Non-conductive tools must be used if electrical hazards may be present. If intrusive activities are within 5 feet (1.5 meters) and parallel to a marked existing utility, the utility location must be exposed and verified by non-aggressive methods every 100 feet (30.5 meters). Check to see if the utility can be isolated during intrusive work.

Intrusive Activities within 2 feet of an Underground Utility

Use non-aggressive methods (hand digging, vacuum excavation, etc.) to perform intrusive activities within 2 feet of a high risk utility (i.e., a utility that cannot be de-energized or would cause significant impacts to repair/replace). Hazardous utilities shall be de-energized whenever possible.

Spotter

A spotter shall be used to monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon, presence of pea gravel or sand in soils, presence of concrete or other debris in soils, refusal of auger or excavating equipment). If any suspicious conditions are encountered stop work immediately and contact the PM or RHSM to evaluate the situation. The spotter must have a method to alert an operator to stop the intrusive activity (e.g., air horn, hand signals).

8.56 Utilities (overhead)

Proximity to Power Lines

It must be determined whether equipment operations including, positioning, and traveling will occur in proximity to power lines within 20 feet (6.1 meters) for line voltage up to 350 kilo volts (kV), and within 50 feet (15.2 meters) for line voltage between 350 kV to 1000 kV. For power lines over 1000 kV, the distance must be determined by the utility/operator or qualified registered professional engineer in electrical power transmission and distribution.

Operations adjacent to overhead power lines are PROHIBITED unless one of the following conditions is satisfied:

- Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked to ensure that no part, including cables, can come within the minimum clearances shown in the table.

MINIMON DISTANCES NOM FOWEREINES										
	Powerlines Nominal System Kv	Minimum Required Distance, Feet (Meters)								
0-50	10	(3.0)								
50-200	15	(4.6)								
	COPYRIGHT 2015 BY CH2M HILL. THE INFORMATIC	ON IN THIS DOCUMENT IS PROPRIETARY."								

MINIMUM DISTANCES FROM POWERLINES

201-350	20 (6.1)
351-500	25 (7.6)
501-750	35 (10.7)
751-1000	45 (13.7)
Over 1000	Established by utility owner/operator or by a professional engineer in electrical power transmission/distribution

(These distances have been determined to eliminate the potential for arcing based on the line voltage.)

- The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine the minimum safe operating distance; get this determination in writing with the utility representative's signature.
- All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the PM prior to the start of work.

8.57 Vacuum Trucks

When CH2M HILL personnel are exposed to vacuum truck operations, the following safe work practices/hazard controls shall be implemented.

- A pre-operational check should be performed on the vacuum truck before use. Operators must be familiar with the operator's manual.
- Operators of vacuum trucks should be trained and familiar with the equipment. At least one person should be operating the boom and one person signaling and assisting the boom operator.
- Before use the hoses and lines should be checked for fraying and connections checked for leakage. Proper selection of hose diameter and type of hose (smooth bore hose vs. corrugated hose) is vital before the job is performed.
- The amount of force produced by a vacuum truck can kill hose operators. If an eight-inch hose gets stuck to your body at 27 inches Hg, it can be fatal. All trucks should be equipped with an emergency release the hose operator or assistant can initiate if a worker gets sucked into a hose. A remote release, manual release near the truck and an inline "T" should be present on the truck. The inline "T" should be installed between the very last section of hose and the working section of hose. The cord that releases the in-line relief should be tethered to the hose handler's belt or a watch buddy should be nearby holding the cord and ready to relieve in the event of an emergency. Operators should never attempt to vacuum hose with any part of their body to check for suction.
- Tanks on vacuum trucks are a confined space. Before the tank is opened and anyone enters a confined space assessment should be performed.
- The truck should always be grounded before use. The static electricity produced when sucking materials into the system can produce a spark and ignite anything in the tank or hose. Use of a grounding wire will prevent static electric explosions. Vacuum trucks should not be used to pump mixtures with a flash point less than 140 degrees or less this is an accepted industry standard refer to the operators manual for more information.
- When positioning truck to work, be extra cautions of personnel and other equipment located next to truck.
- Wet and dry material should not be mixed in the tank.
- When swinging the boom, change directions slowly.

• Do not load dump body beyond rated capacity. Be aware of possible load surge when turning or braking.

8.58 Vinyl Chloride

(Reference CH2M HILL, SOP HSE-512, Vinyl Chloride)

Vinyl Chloride is considered a "Confirmed Human Carcinogen." Vinyl Chloride has a mild, sweet, chloroform-like odor.

CH2M HILL is required to control employee workplace exposure to vinyl chloride when personal exposures are at or above 1.0 ppm as an 8-hour time-weighted average (TWA) or above 5.0 ppm short term exposure limit (STEL), by implementing a program that meets the requirements of the Occupational Safety and Health Administration (OSHA) Vinyl Chloride standard, 29 CFR 1910.1017. The elements of the CH2M HILL vinyl chloride program include the following:

- Exposure monitoring
- Methods of control, including personal protective equipment (PPE) and respirators
- Medical surveillance
- Training on hazards of vinyl chloride and control measures (includes project-specific training and the computer-based training on CH2M HILL's Virtual Office, *Vinyl Chloride*)
- Record keeping requirements

If air monitoring indicates there is potential exposure at the action level concentrations above, notify the RHSM to ensure the above have been adequately addressed. Other exposure control measures include:

- Do not enter regulated work areas unless training, medical monitoring, and PPE requirements established by the competent person have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the competent person.
- Review the fact sheet included as an attachment to the SOP.

8.59 Welding and Cutting

(Reference CH2M HILL, SOP-314, Welding and Cutting)

Below are the hazard controls and safe work practices to follow when working around or performing welding and cutting. Ensure the requirements in the referenced SOP are followed.

- Workers designated to operate welding and cutting equipment shall have been properly instructed and qualified to operate such equipment.
- Before welding or cutting is permitted, the area shall be inspected by the individual responsible for authorizing the welding or cutting operation. The authorization, preferably in the form of a written permit, shall detail precautions to be taken before work is to begin.
- Suitable fire extinguishing equipment shall be immediately available in the work area.
- Flame-resistant blankets shall be used to control sparks produced by welding and cutting operations from traveling to lower levels or adjacent surfaces.
- If the valve on a fuel-gas cylinder is found to leak around the valve stem, the valve shall be closed and the gland nut tightened. If this does not stop the leak, the cylinder is to be tagged and removed from service.

- Nothing should be placed on top of a cylinder or manifold that will damage it or interfere with the quick closing of the valve.
- Flow gages and regulators shall be inspected prior to use and removed from cylinders when not in use.
- Hoses, leads, and cables shall be not be routed through doorways and walkways unless covered, elevated, or protected from damage. Where hoses, leads, and cables pass through wall openings, adequate protection shall be provided to prevent damage.
- Flash arresters shall be installed at the torch handle.
- Arc welding electrodes shall not be struck against compressed gas cylinders to strike an arc.
- All arc welding or cutting operations shall be shielded by noncombustible or flame resistant screens to protect employees or other persons in the vicinity from the direct rays of the arc.
- Proper ventilation shall be provided so as to maintain the level of contaminants in the breathing zone of welders below applicable permissible exposure limits.
- Minimum personal protective equipment includes the following:
 - Safety-toed shoes or boots, hard hats, and safety glasses
 - Body protection (such as gloves, coveralls, or Tyvek) when chemical hazards exist
 - Hearing protection when working in close proximity to loud equipment and machinery
 - Protective clothing and gloves to prevent burns
 - Suitable eye protective equipment for the type of welding or cutting performed
 - Opaque screens to block arc flash from arc welding and cutting operations
 - Mechanical ventilation systems for welding and cutting operations conducted in enclosed or confined spaces
 - Air monitoring or sampling equipment to evaluate airborne concentrations of welding and cutting contaminants
 - Respiratory protection when airborne concentrations of contaminants exceed regulatory limits

8.59.1 Compressed Gas Cylinders

- Cylinders being transported, moved, or stored shall have valve protection caps installed. When transported by motor vehicle, hoisted, or carried, cylinders shall be in the vertical position.
- Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials by a minimum of 20 feet (6.1 meters) or by a noncombustible barrier at least 5 feet (1.5 meters) high having a fire resistant rating of at least one half hour.
- Inside of buildings, cylinders shall be stored in well-ventilated, dry locations at least 20 feet (6.1 meters) from highly combustible materials. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage areas shall be located where cylinders will not be knocked over or damaged.
- During use, cylinders shall be kept far enough away from the actual welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields shall be provided.
- Cylinders containing oxygen or fuel-gas shall not be taken into confined spaces.
- If cylinders are frozen, warm (not boiling) water shall be used to thaw them.

8.59.2 Welding and Cutting Equipment

- Fuel-gas and oxygen hoses shall be easily distinguishable from each other and shall not be interchangeable between fuel-gas and oxygen.
- Hoses shall be inspected at the beginning of each shift. Defective hoses shall be removed from service.
- Hose couplings shall be designed to be disconnected with a rotary motion, not by straight pull.
- Torches shall be inspected at the beginning of each shift for leaking valves, connections, and couplings. Defective torches shall be removed from service.
- Torches shall be ignited with friction lighters, not open flames or hot work.

8.59.3 Arc Welding and Cutting

- Only manual electrode holders that are designed for arc welding or cutting and are capable of safely handling the maximum rated current shall be used.
- Only cable that is free from repair or splices for a minimum distance of 10 feet (3 meters) from the cable's attachment to the electrode holder shall be used.
- Any current-carrying part that arc welders or cutters grip in their hand, as well as the outer surfaces of the jaws of the holder, shall be fully insulated against the maximum voltage encountered to ground.
- The frames of arc welding or cutting machines shall be grounded. Grounding circuits, other than by means of the structure, shall be checked to ensure that the circuit between the ground and the grounded power conductor has resistance low enough to permit sufficient current flow to cause the fuse or circuit breaker to interrupt the current.
- When electrode holders are left unattended, the electrode shall be removed and the holder placed where it cannot harm employees.
- Hot electrode holders shall not be dipped in water to cool them.
- When welding or cutting is stopped for any appreciable length of time, or before the welding or cutting machine is moved, the power shall be shut off.
- Before starting welding or cutting operations, all connections to the machine shall be checked.

8.59.4 Toxic Fumes and Gases

- General mechanical or local exhaust ventilation shall be provided when welding or cutting in a confined space.
- Contaminated air exhausted from the work area shall be discharged into the open air or otherwise clear of the intake air.
- Other employees exposed to the same atmosphere as the welder or cutter shall be protected in the same manner as the welder or cutter.
- In enclosed spaces, all surfaces covered with toxic preservative coatings shall be stripped to a distance of at least four inches from the area to be heated, or the worker shall be protected with an air-line respirator.
- Welding or cutting in an enclosed space shall be performed with local exhaust ventilation or air-line respirators when the following metal bases, fillers, or coatings are involved: lead, cadmium, mercury, zinc, stainless steel, or beryllium.
- Employees welding or cutting in the open air and who are exposed to the metals noted above shall be protected with filter-type respirators; however, when working with beryllium, the employee shall be protected with an air-line respirator.

8.59.5 Fire Prevention

- When the potential for an explosive atmosphere exists in the immediate area of welding or cutting operations, air monitoring instruments shall be used to verify that no explosive atmosphere is present before or during welding or cutting operations.
- When welding or cutting on walls, floors, or ceilings, the same precautions shall be taken on the opposite side as for the welding or cutting side.
- Whenever openings or cracks in the floor, walls, or doorways cannot be closed, precautions shall be taken to prevent combustible materials in other areas from coming in contact with sparks.
- To prevent fire in enclosed spaces, the gas supply to the torch shall be shut off at some point outside the enclosed space whenever the torch is not in use or is left unattended.
- Drums or hollow structures that have contained toxic or flammable substances shall be filled with water or thoroughly cleaned, ventilated, and tested before welding or cutting on them.
- Before heat is applied to a drum, container, or structure, a vent or opening shall be provided to release built-up pressure during the application of heat.
- Before welding or cutting on any surface covered by a preservative coating whose flammability is unknown, a competent person shall test to determine its flammability.
- Preservative coatings shall be considered highly flammable when scrapings burn rapidly.
- When preservative coatings are determined to be highly flammable, they shall be stripped from the area to be heated.

8.60 Working Around Material Handling Equipment

When CH2M HILL personnel are exposed to material handling equipment, the following safe work practices/hazard controls shall be implemented:

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers and equipped with firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.
- Wear a high visibility safety vest or high visibility clothing.

8.61 Working Alone

(Reference CH2M HILL Core Standard, Working Alone)

Personnel can only be tasked to work alone by the Project Manager who shall assess potential hazards and appropriate control measures, with assistance from the Responsible Health and Safety Manager (RHSM).

"Lone workers" with an accountability system in place is permitted, depending on the hazards presented during the execution of the task. Reference the "Lone Worker Protocol" included as an attachment to the project safety plan.

Only limited operations task are permitted to be performed alone. Activities that are not permitted to be performed by a lone worker include the following:

- Working at heights (e.g., on ladders, lifts, scaffolding);
- Energy isolation (e.g., lockout/tagout);
- Any entry into a confined space; and
- Work involving electricity or other hazardous equipment (e.g., chainsaws);
- Work over or near water; and
- Working in an area where there is an increased potential for violence.

An AHA shall be developed that shall include:

- Type or nature of work to be conducted by the lone worker;
- Location of the work
- Length of time the worker will be working alone; and
- Any characteristics of the individual working alone which may increase the risk to the worker (e.g., medical conditions).

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at predetermined times. For some work, a satellite-based communication system may be appropriate (i.e., a "SPOT" device).

Call-In System for Lone Worker Accountability

The employee working alone shall at all times be equipped with a working voice communication device such as a cellular phone, satellite phone, personal alarms, or two-way radio to check-in to their project contact (s) at predetermined times.

Each time before going into the field, a "Call in contact Form" shall be completed by the lone worker and given to the call-in office worker contact prior to going into the field.

During field work, a copy of "The Lone Worker Call-In Contact Form" should be maintained by both the "Office Contact Worker" and the field-worker ("Lone Worker"). Lone Worker and Office Contact Worker must both have cell phones and each others' phone number, plus one other alternate phone number.

Lone worker shall call the office contact worker when he/she has arrived on-site, before exiting his/her vehicle. On this phone call, a time shall be arranged for a "check-in" call to be made by the field worker, based on duration of task. On each "check-in" call a time should be arranged for the next "check-in" call. Document these times on the form.

Lone Worker shall carry his or her cell-phone throughout the field event and put the ringer on its loudest setting as wind or other noise can muffle the sound. If, for any reason the cell-phone becomes inoperable, the field-worker shall immediately stop work, leave the site and find an alternative method of contacting the Office Contact Worker to verify their safety and to inform them of the issue.

Work shall not proceed in the field until the Lone Worker has a working device that provides communication with the Office Contact Worker.

Upon completion of work activities, Lone Worker should pack up all materials and prepare to leave site. Then, before starting the engine of the vehicle to leave site, the Lone Worker should contact the office-worker and

inform him or her that work is complete and that he or she is leaving the site. A final call shall be made by the lone work to the office worker to confirm he/she has reached their destination.

If at any time, the Office Contact Worker does not receive a "check-in" call at the scheduled time he/she should attempt to contact Lone Worker. If no contact is made then the Office Contact Worker should contact the facility contact person to check on the Lone Worker.

If no contact is made with the Lone Worker, then the Office Contact Worker shall contact the PM and/or RHSM to let them know they are going to inform emergency services inform that there is a possible emergency and instruct them to go to the field location and assist the Lone Worker. The Office Contact Worker will provide to emergency services the Lone Worker's name, their last known location, vehicle description and their contact information.

Call in contact Form shall be completed by lone worker and given to call in contact prior to going into the field. Refer to the "Lone Worker Protocol" attached to the project safety plan.

8.62 Working Over Water

If any activities pose a risk to drowning implement the following during the activity:

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PFDs), or a life jacket, shall be worn.
- Provide employees with an approved (USCG for U.S. operations) life jacket or buoyant work vest.
 - Employees should inspect life jackets or work vests daily before use for defects. Do not use defective jackets or vests.
- Post ring buoys with at least 90 feet (27.4 meters) of 3/8-inch solid-braid polypropylene (or equal) line next to the work area. If the work area is large, post extra buoys 200 feet (61 meters) or less from each other.
- Provide at least one life saving skiff, immediately available at locations where employees are working over or adjacent to water.
 - Ensure the skiff is in the water and capable of being launched by one person and is equipped with both motor and oars.
- Designate at least one employee on site to respond to water emergencies and operate the skiff at times when there are employees above water.
 - If the designated skiff operator is not within visual range of the water, provide him or her with a
 radio or provide some form of communication to inform them of an emergency.
 - Designated employee should be able to reach a victim in the water within three to four minutes.
- Ensure at least one employee trained in CPR and first aid is on site during work activities.

9. Physical Hazards and Controls

Physical hazards include exposure to temperature extremes, sun, noise, and radiation. If you encounter a physical hazard that has not been identified in this Handbook or the project safety plan, contact the RHSM so hazard controls can be addressed.

9.1 Noise

(Reference CH2M HILL SOP HSE-108, Hearing Conservation)

CH2M HILL is required to control employee exposure to occupational noise levels of 85 decibels, A-weighted, (dBA) and above by implementing a hearing conservation program that meets the requirements of the OSHA Occupational Noise Exposure standard, 29 CFR 1910.95. A noise assessment may be conducted by the RHSM or designee based on potential to emit noise above 85 dBA and also considering the frequency and duration of the task.

- Areas or equipment emitting noise at or above 90dBA shall be evaluated to determine feasible engineering controls. When engineering controls are not feasible, administrative controls can be developed and appropriate hearing protection will be provided.
- Areas or equipment emitting noise levels at or above 85 dBA, hearing protection must be worn.
- Employees exposed to 85 dBA or a noise dose of 50 percent must participate in the Hearing Conservation program including initial and annual (as required) audiograms.
- The RHSM will evaluate appropriate controls measures and work practices for employees who have experienced a standard threshold shift (STS) in their hearing.
- Employees who are exposed at or above the action level of 85 dBA are required to complete the online Noise Training Module located on CH2M HILL's virtual office.
- Hearing protection will be maintained in a clean and reliable condition, inspected prior to use and after any
 occurrence to identify any deterioration or damage, and damaged or deteriorated hearing protection
 repaired or discarded.
- In work areas where actual or potential high noise levels are present at any time, hearing protection must be worn by employees working or walking through the area.
- Areas where tasks requiring hearing protection are taking place may become hearing protection required areas as long as that specific task is taking place.
- High noise areas requiring hearing protection should be posted or employees must be informed of the requirements in an equivalent manner and a copy of the OSHA standard 29 CFR 1910.95 shall be posted in the workplace.

9.2 Ultraviolet Radiation (sun exposure)

Health effects regarding ultraviolet (UV) radiation are confined to the skin and eyes. Overexposure can result in many skin conditions, including erythema (redness or sunburn), photoallergy (skin rash), phototoxicity (extreme sunburn acquired during short exposures to UV radiation while on certain medications), premature skin aging, and numerous types of skin cancer. Implement the following controls to avoid sunburn.

Limit Exposure Time

- Rotate staff so the same personnel are not exposed all of the time.
- Limit exposure time when UV radiation is at peak levels (approximately 2 hours before and after the sun is at its highest point in the sky).
- Avoid exposure to the sun, or take extra precautions when the UV index rating is high.

Provide Shade

- Take lunch and breaks in shaded areas.
- Create shade or shelter through the use of umbrellas, tents, and canopies.
- Fabrics such as canvas, sailcloth, awning material and synthetic shade cloth create good UV radiation protection.
- Check the UV protection of the materials before buying them. Seek protection levels of 95 percent or greater, and check the protection levels for different colors.

Clothing

- Reduce UV radiation damage by wearing proper clothing; for example, long sleeved shirts with collars, and long pants. The fabric should be closely woven and should not let light through.
- Head protection should be worn to protect the face, ears, and neck. Wide-brimmed hats with a neck flap or "Foreign Legion" style caps offer added protection.
- Wear UV-protective sunglasses or safety glasses. These should fit closely to the face. Wrap-around style glasses provide the best protection.

Sunscreen

- Apply sunscreen generously to all exposed skin surfaces at least 20 minutes before exposure, allowing time for it to adhere to the skin.
- Re-apply sunscreen at least every 2 hours, and more frequently when sweating or performing activities where sunscreen may be wiped off.
- Choose a sunscreen with a high sun protection factor (SPF). Most dermatologists advocate SPF 30 or higher for significant sun exposure.
- Waterproof sunscreens should be selected for use in or near water, and by those who perspire sufficiently to wash off non-waterproof products.
- Check for expiration dates, because most sunscreens are only good for about 3 years. Store in a cool place out of the sun.
- No sunscreen provides 100 percent protection against UV radiation. Other precautions must be taken to avoid overexposure.

9.3 Temperature Extremes

(Reference CH2M HILL SOP HSE-211, Heat and Cold Stress)

Each employee is responsible for the following:

- Recognizing the symptoms of heat or cold stress;
- Taking appropriate precautionary measures to minimize their risk of exposure to temperature extremes (see following sections); and
- Communicating any concerns regarding heat and cold stress to their supervisor or SC.

9.3.1 Heat

California has a specific heat illness prevention regulation that must be implemented. This includes,

- Having enough water onsite so that each worker can consume at a minimum, one quart per hour per shift.
- Frequent reminders and/or water breaks shall be taken so that each person can consume enough water.

- Access to shade (i.e., blockage from direct sunlight) shall be provided at all times and shall be reasonably close to the work area. Keep in mind that a vehicle or other enclosed are with no air conditioning is NOT considered shade. Must be a well ventilated area or have air conditioning.
- Workers shall be allowed to take a work-free cool-down rest/recovery period in the shade for a minimum of five minutes at any time when they feel the need to do so to protect themselves from overheating, or at the first sign of heat illness-related symptoms. (NOTE: If heat related symptoms are occurring, contact the RHSM).
- Training on risk factors, signs and symptoms of heat illness, importance of hydration and acclimatization, and importance of reporting symptoms and what to do in case of heat illness emergency, and contacting emergency medical services (see sections that follow).

Heat-related illnesses are caused by more than just temperature and humidity factors.

Physical fitness influences a person's ability to perform work under heat loads. At a given level of work, the more fit a person is, the less the physiological strain, the lower the heart rate, the lower the body temperature (indicates less retrained body heat—a rise in internal temperature precipitates heat injury), and the more efficient the sweating mechanism.

Acclimatization is a gradual physiological adaptation that improves an individual's ability to tolerate heat stress. Acclimatization requires physical activity under heat-stress conditions similar to those anticipated for the work. With a recent history of heat-stress exposures of at least two continuous hours per day for 5 of the last 7 days to 10 of the last 14 days, a worker can be considered acclimatized. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days and may be completely lost in three to four weeks. Because acclimatization is to the level of the heat-stress exposure, a person will not be fully acclimatized to a sudden higher level; such as during a heat wave.

Dehydration reduces body water volume. This reduces the body's sweating capacity and directly affects its ability to dissipate excess heat.

The ability of a body to dissipate heat depends on the ratio of its surface area to its mass (surface area/weight). **Heat dissipation** is a function of surface area, while heat production depends on body mass. Therefore, overweight individuals (those with a low ratio) are more susceptible to heat-related illnesses because they produce more heat per unit of surface area than if they were thinner. Monitor these persons carefully if heat stress is likely.

When wearing **impermeable clothing**, the weight of an individual is not as important in determining the ability to dissipate excess heat because the primary heat dissipation mechanism, evaporation of sweat, is ineffective.

		FILAT STRESS			
	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny raised red blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool– but not cold– water. Call ambulance, and get medical attention immediately!

SYMPTOMS AND TREATMENT OF HEAT STRESS

Precautions

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°Fahrenheit (10 degrees Celsius [C]) to 60°Fahrenheit (F) (15.6 degrees C) should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons (7.5 liters) per day. Remind employees to drink water throughout their work shift.
- Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate to site work conditions by slowly increasing workloads; for example, do not begin site work with extremely demanding activities. Closely monitor employees during their first 14 days of work in the field.
- Supervisors and SCs must continually observe employees throughout the work shift for signs and symptoms of heat stress or illness. Employees must monitor themselves for heat stress as well as observe their co-workers.
- Effective communication must be maintained with employees throughout the work shift either by voice, observation, or electronic device.
- Use cooling devices, such as cooling vests, to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shade to protect personnel against radiant heat (sun, flames, hot metal).
- Use portable fans for convection cooling or in extreme heat conditions, an air-conditioned rest area when needed.
- In hot weather, rotate shifts of workers.
- Maintain good hygiene standards by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should consult medical personnel.
 - Brief employees initially before the project work begins and routinely as part of the daily safety briefing, on the signs and symptoms of heat-relatedness illnesses, precautions and emergency procedures to follow as described in the project safety plan.
 - Observe one another for signs of heat stress. PREVENTION and communication is key.



Thermal Stress Monitoring Flow Chart

Permeable Clothing – Monitoring Using WBGT

A Wet Bulb Globe Thermometer (WBGT) is the established and preferred means of measuring the environmental factors associated with heat stress and for providing indication of when physiological monitoring or rest regimens should be incorporated into the work schedule. The WBGT is the composite temperature used to estimate the effect of temperature, humidity, wind speed, and solar radiation on the human body.

When permeable work clothes are worn (street clothes or clothing ensembles over modesty clothes), physiological monitoring may be required based on the outcome of the WBGT measurements, taking into account the clothing adjustment factors. Use of the WBGT should generally begin when the heat index reaches 80° F (27° C) as indicated in the Heat Index Table below, or when workers exhibit symptoms of heat stress as indicated above.

If the WBGT is within the TLV (acclimatized workers) or Action Limit (unacclimatized workers) per the tables below, then work may continue while maintaining the established work/rest regimen. If the WBGT reading meets or exceeds either the TLV or Action Level for a work/rest regimen of 15 minutes work and 45 minutes rest, then physiological monitoring will be implemented.

Screening Criteria for TLV and Action Limit for Heat Stress Exposure

Allocation of work in a cycle of work and recovery		TLV (WBGT V (Acclimatize	alues in °F/C°) ed Workers)		Action Limit (WBGT Values in °F/°C°) (Unacclimatized Workers)					
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy		
75-100%	88/31	82/28	_	_	82/28	77/25	_	_		
50-75%	88/31	84/29	82/28	_	83/29	79/26	75/24	_		
25-50%	90/32	86/30	84/29	82/28	85/30	81/27	78/26	76/25		
0-25%	91/33	89/32	87/31	86/30	86/30	84/29	82/28	81/27		

Very Heavy	Very intense activity at fast to maximum pace.
Heavy	Intense arm and trunk work, carrying, shoveling, manually sawing, pushing and pulling heavy loads, walking at a fast pace.
Moderate	Sustained moderate hand, arm, and leg work; light pushing and pulling; normal walking.
Light	Sitting or standing with light manual work using hands or arms; occasional walking.

Notes:

WBGT values are expressed to the nearest degree.

"-"Dashes indicate the need for physiological monitoring because screening criteria are not recommended for this type of work.

Clothing Adjustment Factors for Some Clothing Ensembles*

Clothing Type	Addition to WBGT °F/°C°
Work Clothes (sleeved shirt and pants)	0/0
Cloth (woven material) coveralls	0/0
Double-layer woven clothing	5.4/3
Polypropylene coveralls	0.9/0.5
Limited Use Vapor barrier coveralls	19.8/11

* These values must not be used for completely encapsulating (impermeable) coveralls/suits. Coveralls assume that only modesty clothing is worn beneath.

Thermal Stress Monitoring – Permeable or Impermeable Clothing

When permeable work clothes are worn (street clothes or clothing ensembles over street clothes), regularly observe workers for signs and symptoms of heat stress and implement physiological monitoring as indicated below. This should start when the heat index reaches 80° F (27° C) [see Heat Index Table below], or sooner if workers exhibit symptoms of heat stress indicated in the table above. These heat index values were devised for shady, light wind conditions; exposure to full sunshine can increase the values by up to 15°F (8°C). Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

When wearing impermeable clothing (e.g., clothing doesn't allow for air or water vapor movement such as Tyvek), physiological monitoring as described below shall be conducted when the ambient temperature reaches 70° F (21° C) or sooner when climatic conditions may present greater risk of heat stress combined with wearing unique variations of impermeable clothing, or workers exhibit symptoms of heat stress

Heat Index Temperature (°F)

	1-3	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
1	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
0	50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
5	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
	60	82	84	88	91	95	100	105	110	116	123	129	137				
	65	82	85	89	93	98	103	108	114	121	126	130					
Ĕ	70	83	86	90	95	100	105	112	119	126	134						
	75	84	88	92	97	103	109	116	124	132							
	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Streuous Activity

Caution	Extreme Caution Dang	er Extreme Danger
Heat Index	Possible Heat Disorders	Minimum Frequency of Physiological Monitoring
80°F - 90°F (27°C - 32°C)	Fatigue possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline and observe workers for signs of heat stress and implement physiological monitoring if warranted.
90°F - 105°F (32°C - 41°C)	Sunstroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity	Conduct initial monitoring as baseline, then at least every hour, or sooner, if signs of heat stress are observed.
105°F - 130°F (41°C - 54°C)	Sunstroke, heat cramps, or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity.	Conduct initial monitoring as baseline, then every 30 minutes or sooner if signs of heat stress are observed.
130°F or Higher (54°C or Higher)	Heat/Sunstroke highly likely with continued exposure.	Conduct initial monitoring as baseline, then every 15 minutes or sooner if signs of heat stress are observed.

Source: National Weather Service

Physiological Monitoring and Associated Actions

For employees wearing permeable clothing, follow the minimum frequency of physiological monitoring listed in the Heat Index Table.

For employees wearing impermeable clothing, physiological monitoring should begin initially at a 15 minute interval, then if the employee's heart rate or body temperature is within acceptable limits, conduct the subsequent physiological monitoring at 30 minutes, and follow the established regimen protocol below.

When physiological monitoring is required, use either radial pulse or aural temperature and follow actions below:

• The sustained heart rate during the work cycle should remain below 180 beats per minute (bpm) minus the individual's age (e.g., 180 – 35 year old person = 145 bpm). The sustained heart rate can be estimated by measuring the heart rate at the radial pulse for 30 seconds as quickly as possible prior to starting the rest period.

- The heart rate after one minute rest period should not exceed 120 beats per minute (bpm).
- If the heart rate is higher than 120 bpm after the FIRST minute into the rest period, the next work period should be shortened by 33 percent, while the length of the rest period stays the same.
- If the pulse rate still exceeds 120 bpm at the beginning of the next rest period, the following work cycle should be further shortened by 33 percent.
- Continue this procedure until the rate is maintained below 120 bpm after the FIRST minute into the rest period.

Alternately, the body temperature can be measured, either oral or aural (ear), before the workers have something to drink.

- If the oral or aural temperature exceeds 99.6° F (37.6 ° F) at the beginning of the rest period, the following work cycle should be shortened by 33 percent.
- Continue this procedure until the oral or aural (ear) temperature is maintained below 99.6 ° F (37.6° C). While an accurate indication of heat stress, oral temperature is difficult to measure in the field, however, a digital aural (aural) thermometer is easy to obtain and inexpensive to purchase.

Procedures for when Heat Illness Symptoms are Experienced

- Always contact the RHSM when any heat illness related symptom is experienced so that controls can be evaluated and modified, if needed.
- In the case of cramps, reduce activity, increase fluid intake, move to shade until recovered.
- In the case of all other heat-related symptoms (fainting, heat rash, heat exhaustion), and if the worker is a CH2M HILL worker, contact the occupational physician at 1-866-893-2514 and immediate supervisor.
- In the case of heat stroke symptoms, call 911, have a designee give location and directions to ambulance service if needed, follow emergency medical treatment section of the project safety plan.
- Follow the Incident Notification, Reporting, and Investigation section of this Handbook.

9.3.2 Cold

General

Low ambient temperatures increase the heat lost from the body to the environment by radiation and convection. In cases where the worker is standing on frozen ground, the heat loss is also due to conduction.

Wet skin and clothing, whether because of water or perspiration, may conduct heat away from the body through evaporative heat loss and conduction. Thus, the body cools suddenly when chemical protective clothing is removed if the clothing underneath is perspiration soaked.

Movement of air across the skin reduces the insulating layer of still air just at the skin's surface. Reducing this insulating layer of air increases heat loss by convection.

Non-insulating materials in contact or near-contact with the skin, such as boots constructed with a metal toe or shank, conduct heat rapidly away from the body.

Certain common drugs, such as alcohol, caffeine, or nicotine, may exacerbate the effects of cold, especially on the extremities. These chemicals reduce the blood flow to peripheral parts of the body, which are already high-risk areas because of their large surface area to volume ratios. These substances may also aggravate an already hypothermic condition.

Precautions

- Be aware of the symptoms of cold-related disorders, and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in wet weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Wind-Chill Index (below) is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it should only be used as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- Persons who experience initial signs of immersion foot, frostbite, and/or hypothermia should report it immediately to their supervisor/PM to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm–but not hot–water. Have victim drink warm fluids, but not coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but not coffee or alcohol. Get medical attention.



	Temperature (°F)																		
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
	5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
	10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
	15	32	25	19	13	б	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
	20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
(f	25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
Ē	30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
P	35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
Ň	40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
	45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
	50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
	55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
	60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98
					Frostb	oite Tir	nes	3	0 minu	tes	10	0 minut	es [5 m	inutes				
			W	ind (Chill	(°F) = Whe	= 35. ere, T=	74 + Air Tei	0.62	15T · ture (°	- 35. F) V=	75(V Wind S	0.16) Speed	+ 0.4 (mph)	275	r(V ^{o.}	16) Effe	ective 1	1/01/0

Biological hazards are everywhere and change with the region and season. During project planning stages, ask the site Point of Contact if there are insect or other biological hazards have been noted in any of the work sites.

Biological hazards are everywhere and change with the region and season. If you encounter a biological hazard that has not been identified in the project safety plan or in this Handbook, contact the RHSM so that hazard controls can be addressed. Whether it is contact with a poisonous plant, a poisonous snake, or a bug bite, do not take bites or stings lightly. If there is a chance of an allergic reaction or infection, or to seek medical advice on how to properly care for the injury, contact the occupational nurse at 1-866-893-2514.

10.1 Black Bears

Bears may inhabit wooded areas where there is scarce continuous human presence. Make your presence knownespecially when vegetation and terrain make it hard to see. Make noise, sing, or talk loudly. Avoid thick brush. Try to walk with the wind at your back so your scent will warn bears of your presence.

Give bears plenty of room. Every bear has a "personal space" - the distance within which a bear feels threatened – that can be from a few feet to a few hundred feet. If you stray within that zone, a bear may act aggressively. Never approach bears, even if only out of curiosity, and never attempt to feed bears.

If a bear cannot recognize you, he may come closer or stand on his hind legs for a better view. You may try to back away slowly diagonally, but if the bear follows, stop and stand your ground. If the bear moves closer or acts aggressively, stay close together and wave your arms and shout.

Do not climb a tree – black bears are good climbers.

Do not run. Bears have been clocked at speeds of up to 35 mph, and like dogs, will chase fleeing animals. Bears often make bluff charges, sometimes up to 10 feet away without making contact. Continue waving your arms and shouting. Never imitate bears sounds or use high-pitched squeals.

If attacked, do not run. Clasp your hands tightly over the back of your neck or if you are carrying a backpack use it to protect your head and neck and remain still.

For Black bears, if the attack lasts for more than a few seconds, respond aggressively - use sticks, rocks, your fists or noise. Black bears will sometimes back off if they are challenged.

10.2 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic.

Precautions include:

- Watching for and avoiding nests.
- Keep exposed skin to a minimum.
- Carry a kit if you have had allergic reactions in the past, and inform your supervisor and/or a buddy. When working at a remote location, ensure that first-aid kits contain over-the-counter allergy and itch medication (e.g., Benadryl, Claritin, etc) as well as other over-the-counter medications that may not be available to aid in symptom treatment.
- If bees or other stinging insects are known to be present, determine whether additional protective clothing should be donned before entering/working in brushy areas.
- Before entering a heavily vegetated or brushy area, observe the area for several minutes to see if bees or other stinging insects may be present. If nests or individual insects are observed, retreat and inquire whether a specialist or a client service can be contacted to clear the area before work proceeds.

- Consider if heavy-weight clothing or tyvek, or head netting would provide additional protection in areas where wasps/bees are known or suspected. Be aware of heat stress conditions additional clothing may cause.
- Use insect repellent on clothing. Wear light-colored clothing and remove bright reflective safety-colored • clothing if not working near a roadway as these may attract the wasps.
- Wear fragrance-free or lightly-scented sunscreen, and body lotions. Bees are attracted to sweet scents. • Avoid using floral scented soaps, shampoos, or conditioners.
- Move slowly and calmly through vegetated areas and try to avoid major disturbance of vegetation as • wasps/bees often react to aggressive movement.
- If you encounter a wasp, back away slowly and calmly, do not run or swat at the insect. Wait for it to leave, • or gently move or brush it off gently with a piece of paper or other light object. Do not use your hand.

If you are stung, contact the occupational nurse at 1-866-893-2514, no matter how minor it may seem. If a stinger is present, remove it as soon as possible using something with a thin, hard edge (e.g., credit card) to scrape the stinger out. Be sure to sanitize the object first with hand sanitizer, alcohol or soap and water. Wash and disinfect the wound, cover it, and apply ice. Watch for an allergic reaction if you have never been stung before. Call 911 if the reaction is severe.

10.3 Bird Droppings

Large amounts of bird droppings may present a disease risk. The best way to prevent exposure to fungus spores in bird droppings is to avoid disturbing it. A brief inhalation exposure to highly contaminated dust may be all that is needed to cause infection and subsequent development of fungal disease.

If disturbing the droppings or if removal is necessary to perform work, follow these controls:

- Use dust control measures (wetting with water or HEPA vacuuming) for all activities that may generate • dust from the accumulated droppings.
- Wear Tyvek with hoods, disposable gloves and booties, and air-purifying respirators with a minimum N95 rating.
- Put droppings into plastic/poly bags and preferably into a 55-gallon drum to prevent bag from ripping.

10.4 Cactus

Cacti are present onsite. Contact with cacti can result in dermatitis as well as causing immunologic and infectious reactions. The spines can scratch the skin or induce wounds and multiple abrasions. Some cacti have glochids (hairlike spines or short prickles, generally barbed). Glochids can induce more troublesome, more persistent, dermatological manifestations such as papules or nodules.

Set up the work area to ensure avoidance of cacti. Wear leather glove if working near cacti. Keep any clothing such as jackets away from cacti as spines can become lodged into the clothing and can be contacted by the skin later. Contact the occupational nurse if cactus contact occurs.

10.5 Cougars/Mountain Lions

Like bears, cougars will often retreat if given the opportunity. Walking in groups and making noise will give the cougar the chance to retreat and reduce the likelihood of a sudden encounter. Be especially cautious during dusk and dawn.

If you see a cougar—do not play dead, do not run. Running may trigger an attack. Face the cougar and retreat slowly maintaining eye contact. If the cougar continues advancing, raise your arms above your head to make yourself look larger than normal. This may help to intimidate the cougar. Sometimes aggressive yelling and rock throwing may scare it off.

If attacked, fight back with whatever is at hand (without turning your back)—people have utilized rocks, jackets, garden tools, tree branches, and even bare hands to turn away cougars.

10.6 Coyotes

While far from domesticated, coyotes show little fear of humans and have become comfortable living in close proximity to our communities. Although they tend to do most of their hunting after dusk, coyotes can be active at any time. Under normal circumstances, a coyote is not a danger to humans. They are, however, territorial and will respond aggressively if they or their family are threatened.

If you encounter a coyote that behaves aggressively, you have probably gotten too close to its prey or its family. Try to scare the coyote by yelling and waving your arms. Throw rocks, sticks or other objects. Do not turn away and run.

10.7 Feral Dogs

Avoid all dogs – both leashed and stray. Do not disturb a dog while it is sleeping, eating, or caring for puppies. If a dog approaches to sniff you, stay still. An aggressive dog has a tight mouth, flattened ears and a direct stare. If you are threatened by a dog, remain calm, do not scream and avoid eye contact. If you say anything, speak calmly and firmly. Do not turn and run, try to stay still until the dog leaves, or back away slowly until the dog is out of sight or you have reached safety (e.g., vehicle). If attacked, retreat to vehicle or attempt to place something between you and the dog. If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck and protect your face. If bitten, contact the occupational nurse at 1-866-893-2514. Report the incident to the local authorities.

10.8 Feral Pigs

There are 4 million feral swine in over 39 states, with populations in Texas, Florida and throughout the southeastern United States. They have also been noted in California, Oregon, Nebraska, Kansas, Michigan, and Ohio. Although some of the animals have a distinctive "wild boar" appearance, others may look no different than many breeds of domestic hogs.

Feral pigs or hogs have been known to attack human beings. Perhaps the greater risk, though, is that of contracting a disease from an infected hog. People can catch undulant fever from feral hogs infected with swine brucellosis.

Feral hogs have excellent senses of smell and hearing and normally avoid contact with humans, so making noise, and alerting them to your presence most of the time will help you avoid an encounter. There are occasions of hogs chasing hunters up trees, but these are rare, isolated instances. The vast majority of hogs flee from humans. However, should you find yourself nose-to-snout with an angry pig, the best defense is to climb the nearest tree. If the pig charges, sidestep quickly, taking care to avoid the swing of its tusks and promptly find a tree to scamper up.

10.9 Fire Ants

There are several types of fire ants in the United States that can cause painful bites and allergic reactions. Fire ants aggressively defend their nests by stinging several times after climbing on their victims. Large ant mounds are easily visible, but there can be smaller mounds or nests with little "worked" soil that can be stepped on inadvertently. They can also be under rocks, wood or other debris. Implement the following when fire ants are observed:

- Be aware of fire ants and take care not to stand on ant nests;
- Use insect repellents on clothing and footwear to temporarily discourage ants from climbing; and
- Tuck pants into socks. •

If stung, get away from the area you are standing on, briskly brush off ants—wash affected area with soap. Call the occupational nurse.

10.10Hantavirus

Hantavirus pulmonary syndrome (HPS) is a disease caused by a virus which can be transmitted from certain rodents to humans and is prevalent throughout the United States. Avoid disturbing rodent nests. Contact is most likely to occur when there is a current rodent infestation in things like control boxes, storage sheds, wellheads, remediation equipment, or trailers. Once excreted into the environment by the rodent, hantaviruses can survive in the environment and remain infectious for a period of 2-3 days. Ultraviolet rays in sunlight inactivate hantaviruses.

Nesting material and droppings must be removed if work is necessary in a rodent-infested area. PPE for removal shall include:

- Tyvek coveralls;
- Rubber boots or disposable shoe covers;
- Rubber, latex, or vinyl gloves;
- Respiratory protection such as a full face or half-mask air-purifying respirator with a high-efficiency particulate air (HEPA) filter; and
- Protective goggles if wearing a half-mask respirator.

Spray any urine, droppings, and nesting materials with either a bleach and water solution (1 parts bleach to 9 parts water) or a household disinfectant prepared according to the label instructions for dilution and disinfection time. Soak well and let stand for 15 minutes. Use a paper towel or rag to pick up the materials and dispose of them.

Mop floors after spraying them using bleach and water solution or a disinfectant. Dirt floors can be sprayed with either bleach and water solution or a disinfectant.

Personal protective gear shall be decontaminated upon removal at the end of the day. All potentially infective waste material (including respirator filters) from clean-up operations shall be double-bagged in plastic bags.

Symptoms of HPS

Symptoms develop between 14 and 31 days after exposure to infected rodents and include fatigue, fever, and muscle aches, especially the large muscle groups—thighs, hips, back and sometimes shoulders. About half of all HPS patients also experience headaches, dizziness, chills and/or abdominal pain. Four to 10 days after the initial phase of the illness, late symptoms of HPS may appear. These include coughing and shortness of breath. If you develop symptoms suggestive of HPS, call the occupational nurse at 1-866-893-2514.

10.11Hazards during Hunting Seasons

Various times of the year can be particularly hazardous for personnel working in the field. The danger is highest for our teams doing cross-country surveys of pipelines and transmission lines, but everyone doing field work should be aware of the hunting seasons that are active where you are working.

Big game hunting can be very dangerous, but also be aware of water fowl seasons and hunting seasons for less common game in your area. Work in wetlands can bring us in close proximity to these types of hunters.

If possible consider postponing field surveys so they do not coincide with hunting seasons but if you must be in the field be as visible as possible at all times.

This site gives all the different hunting seasons by state:

www.huntinfo.org/

Implement the following if hunting may be a hazard:

- Do not wear kaki, brown or tan clothing, wear high visibility colors including hats and vests;
- Avoid wearing white or light colored scarves, gloves, handkerchiefs (a woman wearing white mittens hanging laundry was shot and killed as bad hunter shot at flash of white);

- When carrying white plans, field data sheets etc keep them in binder or backpack;
- Wear your safety vest at all times including standing by car/truck;
- Wear a safety hat/cap or put florescent markers on hard hats;
- Be alert particularly in early mornings and at end of day when most hunters are present;
- Avoid being in field altogether at dawn or dusk start a little later in the morning and make sure you get out of the field earlier;
- Stop at local hardware or convenience market and pick up hunter safety gloves, caps, rolls of tape etc. All the stores carry them and they are cheap visual protection.
- Make your presence known, such as slamming car doors, honk horn, talk loudly when getting out to a field site; and
- Stop and survey your surroundings. Many hunters are up in tree stands.

10.12Leeches

Leeches are bloodsucking aquatic or terrestrial worms. They can crawl through or over your socks or brush onto you from shrubbery. They carry no disease and there is low risk of significant blood loss. Leech bites do not hurt since they release an anesthetic, but they can bleed profusely due to an anticoagulant they release to facilitate the flow of blood.

Possible Complications

• Some people suffer allergic reaction from leech bites and require urgent medical care. Symptoms include an ulcer infection, itchy rash, red blotches or an itchy rash over the body, swelling around the lips or eyes, feeling faint or dizzy, and difficulty breathing. If you experience any of these symptoms, seek medical attention immediately.

Prevention options

- The best protection against leeches is covering up and using tropical strength insect repellent on socks and clothing.
- Use anti leech socks and fit over outer garments which served as a barrier.
- Various reports suggest applying salt, dettol spray, bath soap, eucalyptus oil or lemon juice to your skin.
- Inspect your body after leaving leech-infested waters or area, removing them promptly.

First Aid

- Locate the head with a sucker attached to the wound. It will be the narrow end of leech's body.
- Use your fingernail or other flat, blunt object to break the seal of the oral sucker at which point the leech's jaws will detach. Repeat with the posterior end.
- Quickly flick the leech away before it bites you again and reattaches.
- Treat the wound with soap and water and antiseptic wipes; then bandage to stop bleeding.
- Do not just pull off the leech as this may cause a severe wound and the jaws may stay imbedded in the skin
- If the leech has attached to an orifice such ear, nose or mouth use salt or strong (drinkable) alcohol to cause it to release before it expands.
- Apply pressure to the area and a cold pack to reduce pain or swelling.
- The wound normally itches as it heals, but should not be scratched, as this may complicate healing and introduce other infections. Apply an antihistamine if necessary to reduce itching.

- If assisting a bitten person, use the usual protective universal precautions to protect against blood borne pathogens
- Call the occupational nurse.

10.13Mosquito Bites

Due to the recent detection of the West Nile Virus in the southwestern United States it is recommended that preventative measures be taken to reduce the probability of being bitten by mosquitoes whenever possible. Mosquitoes are believed to be the primary source for exposure to the West Nile Virus as well as several other types of encephalitis. The following guidelines should be followed to reduce the risk of these concerns for working in areas where mosquitoes are prevalent:

- Stay indoors at dawn, dusk, and in the early evening;
- Wear long-sleeved shirts and long pants whenever you are outdoors;
- Spray clothing with repellents containing permethrin or N,N-diethyl-meta-toluamide (DEET) since mosquitoes may bite through thin clothing;
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35 percent DEET. Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands; and
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Vitamin B and "ultrasonic" devices are NOT effective in preventing mosquito bites.

Symptoms of Exposure to the West Nile Virus

Most infections are mild, and symptoms include fever, headache, and body aches, occasionally with skin rash and swollen lymph glands. More severe infection may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, rarely, death.

The West Nile Virus incubation period is from 3 to 15 days.

Contact the project RHSM with questions, and immediately report any suspicious symptoms to your supervisor, PM, and contact the occupational nurse at 1-866-893-2514.

10.14 Poison Ivy, Poison Oak, and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Shrubs are usually 12 to 30 inches high, or can also be a tree-climbing vine, with triple leaflets and short, smooth hair underneath. Plants are red and dark green in spring and summer, with yellowing leaves anytime especially in dry areas. Leaves may achieve bright reds in fall, but plants lose its (yellowed, then brown) leaves in winter, leaving toxic stems. All parts of the plant remain toxic throughout the seasons. These plants contain urushiol a colorless or pale yellow oil that oozes from any cut or crushed part of the plant, including the roots, stems and leaves and causes allergic skin reactions when contacted. The oil is active year round.

Become familiar with the identity of these plants (see below). Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Poison Ivy

Poison Sumac









Contamination with poison ivy, sumac or oak can happen through several pathways, including:

- Direct skin contact with any part of the plant (even roots once above ground foliage has been removed).
- Contact with clothing that has been contaminated with the oil.
- Contact from removing shoes that have been contaminated (shoes are coated with urishol oil).
- Sitting in a vehicle that has become contaminated.
- Contact with any objects or tools that have become contaminated.
- Inhalation of particles generated by weed whacking, chipping, vegetation clearing.

If you must work on a site with poison ivy, sumac or oak the following precautions are necessary:

- Do not drive vehicles onto the site where it will come into contact with poison ivy, sumac or oak. Vehicles which need to work in the area, such as drill rigs or heavy equipment must be washed as soon as possible after leaving the site.
- All tools used in the poison ivy, sumac or oak area, including those used to cut back poison oak, surveying instruments used in the area, air monitoring equipment or other test apparatus must be decontaminated before they are placed back into the site vehicle. If on-site decontamination is not possible, use plastic to wrap any tools or equipment until they can be decontaminated.
- Personal protective equipment, including Tyvek coveralls, gloves, and boot covers must be worn. PPE must be placed into plastic bags and sealed if they are not disposed immediately into a trash receptacle.
- As soon as possible following the work, shower to remove any potential contamination. Any body part with
 suspected or actual exposure should be washed with Zanfel, Tecnu or other product designed for removing
 urishiol. If you do not have Zanfel or Tecnu wash with cold water. Do not take a bath, as the oils can form
 and invisible film on top of the water and contaminate your entire body upon exiting the bath.
- Tecnu may also be used to decontaminate equipment.
- Use IvyBlock or similar products to prevent poison oak, ivy and sumac contamination. Check with the closest CH2M HILL warehouse to see if these products are available. Follow all directions for application.
- If you do come into contact with one of these poisonous plants and a reaction develops, contact your supervisor and the occupational nurse 1-866-893-2514. Be aware that in some instances, there can be a delay between contact with poisonous plants and the symptoms. If you are working near poison ivy or other poisonous plants and feel a mild skin irritation, apply Zanfel/Technu immediately and contact the occupational nurse.

10.15Scorpions

Scorpions usually hide during the day and are active at night. They may be hiding under rocks, wood, or anything else lying on the ground. Some species may also burrow into the ground. Most scorpions live in dry, desert areas; however, some species can be found in grasslands, forests, and inside caves.

When entering an area that has the potential to contain scorpions, the following PPE is recommended: long pants, long sleeved shirts with collars, leather work gloves and leather work boots. Reaching into enclosures or recesses without prior visual inspection is not recommended. Thoroughly inspect each area before accessing. Shake out clothing, jackets, shoes or boots prior to putting them on.

If you are stung by a scorpion, call the occupational nurse 1-866-893-2514 and try to note the description of the scorpion. Cleanse the sting area and apply ice.

10.16Snakes

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Call the occupational nurse at 1-866-893-2514 immediately. Do not apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings. Below is a guide to identifying poisonous snakes from non-poisonous snakes.



10.17Spiders - Brown Recluse and Widow

The Brown Recluse spider can be found most anywhere in the United States. It varies in size in shape, but the distinguishing mark is the violin shape on its body. They are typically non-aggressive. Keep an eye out for irregular,

pattern-less webs that sometimes appear almost tubular built in a protected area such as in a crevice or between two rocks. The spider will retreat to this area of the web when threatened.

The Black Widow, Red Widow and the Brown Widow are all poisonous. Most have globose, shiny abdomens that are predominantly black with red markings (although some may be pale or have lateral stripes), with moderately long, slender legs. These spiders are nocturnal and build a three-dimensional tangled web, often with a conical tent of dense silk in a corner where the spider hides during the day.

Hazard Controls

- Inspect or shake out any clothing, shoes, towels, or equipment before use.
- Wear protective clothing such as a long-sleeved shirt and long pants, hat, gloves, and boots when handling stacked or undisturbed piles of materials.
- Minimize the empty spaces between stacked materials.
- Remove and reduce debris and rubble from around the outdoor work areas.
- Trim or eliminate tall grasses from around outdoor work areas.
- Store apparel and outdoor equipment in tightly closed plastic bags.
- Keep your tetanus boosters up-to-date (every 10 years). Spider bites can become infected with tetanus spores.

If you think you have been bit by a poisonous spider, immediately call the occupational nurse at 1-866-893-2514 and follow the guidance below:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood;
- Apply a cool, wet cloth to the bite or cover the bite with a cloth and apply an ice bag to the bite;
- Elevate the bitten area, if possible;
- Do not apply a tourniquet, do not try to remove venom; and
- Try to positively identify the spider to confirm its type. If the spider has been killed, collect it in a plastic bag or jar for identification purposes. Do not try to capture a live spider—especially if you think it is a poisonous spider.



Black Widow

10.18Ticks



Every year employees are exposed to tick bites at work and at home putting them at risk of illness. Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch (6.4 mm) in size.

In some geographic areas exposure is not easily avoided. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

Where site conditions (vegetation above knee height, tick endemic area) or when tasks (having to sit or kneel in vegetation) diminish the effectiveness of the other controls mentioned above, bug-out suits (check with your local or regional warehouse) or Tyvek shall be used. Bug-out suits are more breathable than Tyvek.

Take precautions to avoid exposure by including pre-planning measures for biological hazards prior to starting field work. Avoid habitats where possible, reduce the abundance through habitat disruption or application of acracide. If these controls aren't feasible, contact your local or regional warehouse for preventative equipment such as repellants, protective clothing and tick removal kits. Use the buddy system and perform tick inspections prior to entering the field vehicle. If ticks were not planned to be encountered and are observed, do not continue field work until these controls can be implemented.

See Tick Fact Sheet attached to project safety plan for further precautions and controls to implement when ticks are present. If bitten by a tick, follow the removal procedures found in the tick fact sheet, and call the occupational nurse at 1-866-893-2514.

Be aware of the symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme disease is a rash that might appear that looks like a bull's eye with a small welt in the center. RMSF is a rash of red spots under the skin 3 to 10 days after the tick bite. In both RMSF and Lyme disease, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, again contact the occupational nurse at 1-866-893-2514.

Be sure to complete an Incident Report (either use the Hours and Incident Tracking System [HITS] system on the VO) if you do come in contact with a tick.

11. Personal Protective Equipment

(Reference CH2M HILL- SOP HSE-117, Personal Protective Equipment)

11.1 Required Personal Protective Equipment

PPE must be worn by employees when actual or potential hazards exist and engineering controls or administrative practices cannot adequately control those hazards.

A PPE assessment has been conducted by the RHSM based on project tasks (see PPE specifications below). Verification and certification of assigned PPE by task is completed by the RHSM in each project safety plan. Below are items that need to be followed when using any form of PPE:

- Employees must be trained to properly wear and maintain the PPE; if you are unsure of how to use or maintain your PPE, ask your RHSM for guidance.
- Employees must be trained in the limitations of the PPE; if you are unsure, ask your RHSM for guidance.
- In work areas where actual or potential hazards are present at any time, PPE must be worn by employees working or walking through the area;
- Areas requiring PPE should be posted or employees must be informed of the requirements in an equivalent manner;
- PPE must be inspected prior to use and after any occurrence to identify any deterioration or damage;
- PPE must be maintained in a clean and reliable condition;
- Damaged PPE shall not be used and must either be repaired or discarded; and
- PPE shall not be modified, tampered with, or repaired beyond routine maintenance.

Each project safety plan will outlines PPE to be used according to task based on project-specific hazard assessment.

11.2 Respiratory Protection

(Reference CH2M HILL SOP HSE-121, Respiratory Protection)

Implement the following when using respiratory protection:

- Respirator users must have completed appropriate respirator training within the past 12 months. Level C training is required for air-purifying respirators (APR) use and Level B training is required for supplied-air respirators (SAR) and self-contained breathing apparatus (SCBA) use. Specific training is required for the use of powered air-purifying respirators (PAPR);
- Respirator users must complete the respirator medical monitoring protocol and been approved for the specific type of respirator to be used;
- Tight-fitting facepiece respirator (negative or positive pressure) users must have passed an appropriate fit test within past 12 months;
- Respirator use shall be limited to those activities identified in the safety plan. If site conditions change that alters the effectiveness of the specified respiratory protection, the RHSM shall be notified to amend the written plan;
- Tight-fitting facepiece respirator users shall be clean-shaven and shall perform a user seal check before each use;
- Canisters/cartridges shall be replaced according to the change-out schedule specified in the safety plan. Respirator users shall notify the SC or RHSM of any detection of vapor or gas breakthrough. The SC shall report any breakthrough events to the RHSM for schedule upgrade;

- Respirators in regular use shall be inspected before each use and during cleaning;
- Respirators in regular use shall be cleaned and disinfected as often as necessary to ensure they are maintained in a clean and sanitary condition;
- Respirators shall be properly stored to protect against contamination and deformation;
- Field repair of respirators shall be limited to routine maintenance. Defective respirators shall be removed from service;
- When breathing air is supplied by cylinder or compressor, the SC or RHSM shall verify the air meets Grade D air specifications; and
- The SC or designee shall complete the Self-Assessment Checklist Respiratory Protection included in the SOP and/or in the safety plan to verify compliance with CH2M HILL's respiratory protection program.

12.1 CH2M HILL Worker Training

(Reference CH2M HILL SOP HSE-110, Training)

12.1.1 Hazardous Waste Operations Training

All employees engaging in hazardous waste operations or emergency response shall receive appropriate training as required by 29 CFR 1910.120 and 29 CFR 1926.65. At a minimum, the training shall have consisted of instruction in the topics outlined in 29 CFR 1910.120 and 29 CFR 1926.65. Personnel who have not met these training requirements shall not be allowed to engage in hazardous waste operations or emergency response activities.

12.1.1.1 Initial Training

General site workers engaged in hazardous waste operations shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations, unless otherwise noted in the above-referenced standards.

Employees who may be exposed to health hazards or hazardous substances at treatment, storage, and disposal (TSD) operations shall receive a minimum of 24 hours of initial training to enable the employee to perform their assigned duties and functions in a safe and healthful manner.

Employees engaged in emergency response operations shall be trained to the level of required competence in accordance with 29 CFR 1910.120.

12.1.1.2 Three-Day Actual Field Experience

General site workers for hazardous waste operations shall have received three days of actual experience (on-thejob training) under the direct supervision of a trained, gualified supervisor and shall be documented. If the field experience has not already been received and documented at a similar site, this supervised experience shall be accomplished and documented at the beginning of the assignment of the project.

12.1.1.3 Refresher Training

General site workers and TSD workers shall receive 8-hours of refresher training annually (within the previous 12-month period) to maintain qualifications for fieldwork. Employees engaged in emergency response operations shall receive annual refresher training of sufficient content and duration to maintain their competencies or shall demonstrate competency in those areas at least annually.

12.1.1.4 Eight-Hour Supervisory Training

On site management or supervisors who will be directly responsible for, or supervise employees engaged in hazardous waste site operations, will have received at least 8 hours of additional specialized training on managing such operations. Employees designated as Safety Coordinator – Hazardous Waste are considered 8-hour HAZWOPER Site Safety Supervisor trained.

12.1.2 Competent Person

The term "Competent Person" is used in many OSHA and International standards and documents. OSHA defines a "competent person" as one who, by way of training and/or experience, 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. Some standards add additional specific requirements which must be met by the competent person.

CH2M HILL's practice is that the employer responsible for directing the means and methods of an activity (typically the employer responsible for actually performing the work) is responsible for designating the qualified competent person for that activity. This is typically a subcontractor or a third party contractor, unless CH2M HILL is actually self-performing the work.

Should CH2M HILL self-perform work and an employee needs to be designated as a competent person, the CH2M HILL site or project manager shall coordinate with the BG HSE Lead or RHSM to verify that the employee has the requisite training and experience to be identified as the competent person.

12.1.3 First Aid/Cardiopulmonary Resuscitation

First aid and CPR training consistent with the requirements of a nationally recognized organization such as the American Red Cross Association or National Safety Council shall be administered by a certified trainer. A minimum of two personnel per active field operation will have first aid and CPR training. Bloodborne pathogen training located on CH2M HILL's Virtual Office is also required for those designated as first aid/CPR trained.

12.1.4 Safety Coordinator Training

SCs are trained to implement the HSE program on CH2M HILL field projects. A qualified SC is required to be identified in the project safety plan for CH2M HILL field projects. SCs must also meet the requirements of the worker category appropriate to the type of field project (construction or hazardous waste). In addition, the SCs shall have completed additional safety training required by the specific work activity on the project that qualifies them to implement the HSE program (for example, fall protection, excavation).

12.1.5 Site-Specific Training

Site-specific training will be addressed in the project safety plan. Prior to commencement of field activities, all field personnel assigned to a project will have completed site-specific training that will address the contents of applicable project safety plans, including the activities, procedures, monitoring, and equipment used in the site operations. Site-specific training will also include site and facility layout, potential hazards, risks associated with identified emergency response actions, and available emergency services. This training allows field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and work operations for their particular activity.

(Reference CH2M HILL SOP HSE-113, Medical Surveillance)

All site workers participating in hazardous waste operations or emergency response (HAZWOPER) will maintain an adequate medical surveillance program in accordance with 29 CFR 1910.120 or 29 CFR 1926.65 and other applicable OSHA standards. Documentation of employee medical qualification (e.g., physician's written opinion) will be maintained in the project files and made available for inspection.

13.1 Hazardous Waste Operations and Emergency Response

CH2M HILL personnel expected to participate in on site HAZWOPER tasks are required to have a current medical qualification for performing this work. Medical qualification shall consist of a qualified physician's written opinion regarding fitness for duty at a hazardous waste site, including any recommended limitations on the employee's assigned work. The physician's written opinion shall state whether the employee has any detected medical conditions that would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

13.2 Respirator User Qualification

Personnel required to wear respirators must have a current medical qualification to wear respirators. Medical qualification shall consist of a qualified physician's written opinion regarding the employee's ability to safely wear a respirator in accordance with 29 CFR 1910.134.

13.3 Hearing Conservation

Personnel working in hazardous waste operations or operations that fall under 29 CFR 1910.95 and exposed to noise levels in excess of the 85dBA time-weighted average shall be included in a hearing conservation program that includes annual audiometric testing.

14.1 Site-Control Procedures

(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations)

Site control is established to prevent the spread of contamination throughout the site and to ensure that only authorized individuals are permitted into potentially hazardous areas.

The SC will implement site control procedures including the following bulleted items.

- Establish support, contamination reduction, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
 - Line-of-sight and hand signals;
 - Air horn; and
 - Two-way radio or cellular telephone if available.
- Establish offsite communication.
- Establish and maintain the "buddy system."

14.2 Remediation Work Area Zones

(Reference CH2M HILL SOP HSE-218 Hazardous Waste Operations)

A three-zone approach will be used to control areas where site contaminants exist. Access will be allowed only after verification of appropriate training and medical qualification. The three-zone approach shall include an EZ, Contamination Reduction Zone (CRZ) and a Support Zone (SZ). The three-zone approach is not required for construction work performed outside contaminated areas where control of site contamination is not a concern.

Specific work control zones shall be established as necessary during task planning. Site work zones should be modified in the field as necessary, based on such factors as equipment used, air monitoring results, environmental conditions, or alteration of work plans. The following guidelines shall be used for establishing and revising these preliminary zone designations.

14.2.1 Support Zone

The SZ is an uncontaminated area (trailers, offices, field vehicles, etc.) that will serve as the field support area for most operations. The SZ provides field team communications and staging for emergency response. Appropriate sanitary facilities and safety and emergency response equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone. The only exception will be appropriately packaged and decontaminated materials, or personnel with medical emergencies that cannot be decontaminated.

14.2.2 Contamination Reduction Zone

The CRZ is established between the EZ and the SZ, upwind of the contaminated area where possible. The CRZ provides an area for decontamination of personnel, portable handheld equipment and tools, and heavy equipment. In addition, the CRZ serves as access for heavy equipment and emergency support services.

14.2.3 Exclusion Zone

The EZ is where activities take place that may involve exposure to site contaminants and/or hazardous materials or conditions. This zone shall be demarcated to prevent unauthorized entry. More than one EZ may be established if there are different levels of protection to be employed or different hazards that exist in the same work area. The EZ

shall be large enough to allow adequate space for the activity to be completed, including field personnel and equipment, as well as necessary emergency equipment.

The EZ shall be demarcated with some form of physical barrier or signage. The physical barrier or signage shall be placed so that they are visible to personnel approaching or working in the area. Barriers and boundary markers shall be removed when no longer needed.

14.2.4 Other Controlled Areas

Other work areas may need to be controlled due to the presence of an uncontrolled hazard, to warn workers of requirements, or to prevent unauthorized entry. Examples include general construction work areas, open excavations, high noise areas, vehicle access areas, and similar activities or limited access locations. These areas shall be clearly demarcated with physical barriers (fencing, cones, reinforced caution tape or rope) as necessary and posted with appropriate signage.
(Reference CH2M HILL SOP HSE-218, Hazardous Waste Operations)

Decontamination areas will be established for work in potentially contaminated areas to prevent the spread of contamination. Decontamination areas should be located upwind of the exclusion zone where possible and should consider any adjacent or nearby projects and personnel. The SC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC. The SC must ensure that procedures are established for disposing of materials generated on the site.

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC should establish areas for eating, drinking, and smoking.

15.1 Contamination Prevention

Preventing or avoiding contamination of personnel, tools, and equipment will be considered in planning work activities at all field locations. Good contamination prevention and avoidance practices will assist in preventing worker exposure and result in a more efficient decontamination process. Procedures for contamination prevention and avoidance include the following:

- Do not walk through areas of obvious or known contamination; •
- Do not directly handle or touch contaminated materials; •
- Make sure there are no cuts or tears in PPE;
- Fasten all closures in suits and cover them with duct tape, if appropriate; •
- Take particular care to protect any skin injuries; •
- Stay upwind of airborne contamination, where possible;
- Do not eat or drink in contaminated work areas; •
- Do not carry food, beverages, tobacco, or flame-producing equipment into contaminated work areas; •
- Minimize the number of personnel and amount of equipment in contaminated areas to that necessary for • accomplishing the work;
- Choose tools and equipment with nonporous exterior surfaces that can be easily cleaned and • decontaminated;
- Cover monitoring and sampling equipment with clear plastic, leaving openings for the sampling ports, as • necessary; and
- Minimize the amount of tools and equipment necessary in contaminated areas.

15.2 Personnel and Equipment Decontamination

Personnel exiting an EZ must ensure that they are not spreading potential contamination into clean areas or increasing their potential for ingesting or inhaling potential contaminants. Personal decontamination may range from removing outer gloves as exiting the EZ, to proceeding through an outer layer doffing station including a boot and glove wash and rinse, washing equipment, etc. Equipment that has come into contact with contaminated media must also be cleaned/decontaminated when it is brought out of the EZ.

15.3 Decontamination During Medical Emergencies

Standard personnel decontamination practices will be followed whenever possible. For emergency life saving first aid and/or medical treatment, normal decontamination procedures may need to be abbreviated or omitted. In this situation, site personnel shall accompany contaminated victims to advise emergency response personnel on potential contamination present and proper decontamination procedures.

Outer garments may be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Protective clothing can be cut away. If the outer garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances or medical personnel. Outer garments can then be removed at the medical facility.

15.4 Waste Collection and Disposal

All contaminated material generated through the personnel and equipment decontamination processes (e.g., contaminated disposable items, gross debris, liquids, sludges) will be properly containerized and labeled, stored at a secure location, and disposed in accordance with the project plans.

15.5 Diagram of Personnel-Decontamination Line

The following figure illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC to accommodate task-specific requirements.





Typical Contamination Reduction Zone



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16. Emergency Preparedness

(Reference CH2M HILL SOP HSE-106, Emergency Planning)

16.1 Pre-Emergency Planning

The Emergency Response Coordinator (ERC), typically the SC or designee, performs the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency-service providers as appropriate. Pre-Emergency Planning activities performed by the ERC include:

- Review the facility emergency and contingency plans where applicable;
- Determine what onsite communication equipment is available (two-way radio, air horn);
- Determine what offsite communication equipment is needed (nearest telephone, cell phone);
- Confirm and post the "Emergency Contacts" page and route to the hospital located in this section in project trailer(s) and keep a copy in field vehicles along with evacuation routes and assembly areas. Communicate the information to onsite personnel and keep it updated;
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear;
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures;
- Where appropriate and acceptable to the client, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies;
- Inventory and check site emergency equipment, supplies, and potable water;
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases;
- Rehearse the emergency response plan before site activities begin. This may include a "tabletop" exercise or an actual drill depending on the nature and complexity of the project. Drills should take place periodically but no less than once a year;
- Brief new workers on the emergency response plan; and
- The ERC will evaluate emergency response actions and initiate appropriate follow-up actions.

16.2 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Notify appropriate response personnel;
- Shut down CH2M HILL operations and evacuate the immediate work area;
- Account for personnel at the designated assembly area(s);
- Assess the need for site evacuation, and evacuate the site as warranted;
- Implement HSE-111, Incident Notification, Reporting and Investigation; and
- Notify and submit reports to clients as required in contract.

Small fires or spills posing minimal safety or health hazards may be controlled with onsite spill kits or fire extinguishers without evacuating the site. When in doubt evacuate. Follow the incident reporting procedures in the "Incident Notification, Reporting, and Investigation" section of this Handbook.

16.3 Emergency Medical Treatment

Emergency medical treatment is needed when there is a life-threatening injury (such as severe bleeding, loss of consciousness, breathing or heart has stopped). When in doubt if an injury is life-threatening or not, treat it as needing emergency medical treatment.

- Notify 911 or other appropriate emergency response authorities as listed in the "Emergency Contacts" page located in this section.
- The ERC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury, perform decontamination (if applicable) where feasible; lifesaving and first aid or medical treatment takes priority.
- Initiate first aid and CPR where feasible.
- Notify supervisor and if the injured person is a CH2M HILL employee, the supervisor will call the occupational nurse at 1-866-893-2514 and make other notifications as required by HSE SOP-111, *Incident Notification, Reporting and Investigation*.
- Make certain that the injured person is accompanied to the emergency room.
- Follow the Serious Incident Reporting process in HSE SOP-111, Incident Notification, Reporting and Investigation, and complete incident report using the HITS system on the VO or if not feasible, use the hard copy forms provided as an attachment to the project safety plan.
- Notify and submit reports to client as required in contract.

16.4 Evacuation

- Evacuation routes, assembly areas, and severe weather shelters (and alternative routes and assembly areas) are to be specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the ERC or designee before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The ERC and a "buddy" will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The ERC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The ERC will follow the incident reporting procedures in the "Incident Notification, Reporting and Investigation" section of this Handbook.

16.5 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

16.6 Inclement Weather

Sudden inclement weather can rapidly encroach upon field personnel. Preparedness and caution are the best defenses. Field crew members performing work outdoors should carry clothing appropriate for inclement weather. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.

Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop—seek low areas); staying away from open water, metal equipment, railroad tracks, wire fences, and metal pipes; and positioning people several yards apart. Some other general precautions include:

- Know where to go and how long it will take to get there. If possible, take refuge in a large building or vehicle. Do not go into a shed in an open area;
- The inclination to see trees as enormous umbrellas is the most frequent and most deadly mistake. Do not go under a large tree that is standing alone. Likewise, avoid poles, antennae, and towers;
- If the area is wide open, go to a valley or ravine, but be aware of flash flooding;
- If you are caught in a level open area during an electrical storm and you feel your hair stand on end, drop to your knees, bend forward and put your hands on your knees or crouch. The idea is to make yourself less vulnerable by being as low to the ground as possible and taking up as little ground space as possible. Lying down is dangerous, since the wet earth can conduct electricity. Do not touch the ground with your hands; and
- Do not use telephones during electrical storms, except in the case of emergency.

Remember that lightning may strike several miles from the parent cloud, so work should be stopped and restarted accordingly. The lightning safety recommendation is 30-30: Seek refuge when thunder sounds within 30 seconds after a lightning flash; and do not resume activity until 30 minutes after the last thunder clap.

High winds can cause unsafe conditions, and activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

16.6.1 Tornado Safety

Recognizing imminent tornado signs include seeing an unusually dark sky, possibly with some green or yellow clouds. You may hear a roaring or rumbling sound like a train, or a whistling sound like a jet. Large hail may also be falling. You may be able to see funnels, or they may be hidden by rain or hail.

Listen to your radio for tornado warnings during bad thunderstorms. If a tornado warning is issued, don't panic. Instead, listen and look. Quickly but calmly follow directions for getting to shelter.

Take cover. Indoors you should go down into the basement and crouch down under the stairs, away from windows. Do not take an elevator. If you can't get to a basement, go into a closet or bathroom and pull a mattress over you or sit underneath a sturdy piece of furniture on the ground floor near the center of the building. Pull your knees up under you and protect your head with your hands.

A bad place to be in a tornado is in a building with a large freestanding roof such as a gymnasium, arena, auditorium, church or shopping mall. If you are caught in such a building, take cover under something sturdy.

More than half of tornado deaths occur in mobile homes. If a tornado threatens, get out and go to a building with a good foundation, or lay down in a ditch away from vehicles and other objects.

If you are driving, get to a shelter, lie down in a ditch or seek cover up under the girders of an overpass or bridge. Stay as close to the ground as you can. Protect your head and duck flying debris. Stay away from metal and electrical equipment because lightning accompanies tornadoes.

If you have time before the tornado strikes, secure objects such as garbage cans and lawn furniture which can injure people. While most tornado damage is a result of the violent winds, most injuries and deaths actually result from flying debris.

17.1 Management Health, Safety, Security, and Environment Inspections

The <u>Management Inspection Checklist</u> is intended to facilitate PM leadership, provide an opportunity for PM's to mentor field staff on HSE and identify any big picture actions that need to be addressed. Observations that would improve global HSE program should also be included on the form. This Checklist does NOT take the place of a formal HSE audit. The PM shall:

- Complete one checklist per month during field work when visiting the site. The PM may delegate completion to the task lead, field team leader, or construction manager if the project is short duration and a visit is not planned for.
- Complete applicable sections of the checklist (can by typed or hand-written). Address issues with the field team, taking the opportunity to mentor staff by identifying the "root cause" of observation (e.g., why are SBOs not being completed, had this hazard been noted by any other team members?).
- E-mail the completed form to the address listed at the bottom of the form, and courtesy copy the Project Delivery Manager, Sector HSE Lead, and RHSM for tracking and review. Original should be kept in the project files.

17.2 Project Activity Self-Assessment Checklists

In addition to the hazard controls specified in this document, Project Activity Self-Assessment Checklists are contained as an attachment to the project safety plan. The Project-Activity Self-Assessment Checklists are based upon minimum regulatory compliance and some site-specific requirements may be more stringent. The objective of the self-assessment process is to identify gaps in project safety performance, and prompt for corrective actions in addressing these gaps. The self-assessment checklists, including documented corrective actions, shall be made part of the permanent project records and maintained by the SC.

The self-assessment checklists will also be used by the SC in evaluating the subcontractors and any client contractors' compliance on site.

17.3 Safe Behavior Observations

Safe Behavior Observations (SBOs) are a tool to be used by supervisors to provide positive reinforcement for work practices performed correctly, while also identifying and eliminating deviations from safe work procedures that could result in a loss.

The SC or designee shall perform at least one SBO each week for any field work performed by subcontractors or when there are at least two CH2M HILL personnel performing field work.

The SC or designee shall complete the SBO form (attached to the project safety plan) for the task/operation being observed and submit them weekly.

E-mail the completed form to the appropriate e-mail address at the bottom of the <u>SBO Form</u>.

18. Incident Notification, Reporting, and Investigation

(Reference CH2M HILL SOP HSE-111, Incident Notification, Reporting and Investigation)

18.1 General Information

This section applies to the following:

- All injuries involving employees, third parties, or members of the public;
- Damage to property or equipment;
- Interruptions to work or public service (hitting a utility);
- Incidents which attract negative media coverage;
- Near misses;
- Spills, leaks, or regulatory violations; and
- Motor vehicle incidents.

Documentation, including incident reports, investigation, analysis and corrective measure taken, shall be kept by the SC and maintained onsite for the duration of the project.

18.2 Section Definitions

Incident: An incident is an event that causes or could have caused undesired consequences. An incident may be caused by natural forces, employees, subcontractors, or third parties in any location associated with CH2M HILL operations, including offices, warehouses, project sites, private property, or public spaces. Incidents include:

- Injury or illness to a CH2M HILL employee or subcontractor employee, or member of the public;
- Property damage;
- Spill or release;
- Environmental requirement or permit violation;
- A "near-miss"; or
- Other (e.g., fire, explosion, bomb threat, workplace violence, threats)

Near Miss: A near-miss occurs when an intervening factor prevented an injury or illness, property damage, spill or release, permit violation or other event from occurring. Examples of near-miss situations include: a hard hat or other personal protective equipment (PPE) prevented an injury; secondary containment or emergency shutoff prevented a spill; or an alert co-worker prevented an incident.

Serious Incident

A Serious Incident must be immediately reported to senior management includes:

- Work related death, or life threatening injury or illness of a CH2M HILL employee;
- subcontractor, or member of the public;
- Kidnap/missing person;
- Acts or threats of terrorism;

- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

18.3 Reporting Requirements

All employees and subcontractors' employees shall immediately report any incident in which they are involved or witness verbally to the SC or HS Manager and Field Team Leader or Site Supervisor (including "near misses").

Incident notification is made through <u>both</u> the HSE and the Operations chain of command. Upon notification of an incident, the SC or HS Manager initiates the HSE notification chain, and the Field Team Leader or Supervisor initiates the Operations notification chain.

If the incident was an environmental permit issue (potential permit non-compliance, other situation that result in a notice of violation) or a spill or release, contact the Project EM immediately so evaluation of reportable quantity requirements and whether agency reporting is required.

All recordable incidents and regulatory agency actions are reported up to the E&NBG President and the HSE Director. Other incident notification is made up the chains to the indicated group depending on the severity, and any project, geographic, or client specific notification and reporting requirements.

The CH2M HILL team shall comply with all applicable statutory incident reporting requirements such as those to OSHA, the police, or state or Federal environmental agency.

Be aware that many OSHA-designated states require reporting to the area OSHA office if one person is admitted to the hospital (e.g., California and Washington); whereas Federal OSHA requires it if three or more are admitted.

18.4 Drug and Alcohol Testing for CH2M HILL Employees

As required by CH2M HILL Policy 810, U.S. Employees are subject to post-incident and reasonable suspicion drug and alcohol testing. The Employee must submit to drug and alcohol testing if the supervisor has a reasonable suspicion, and when any of the following occur:

- Work-related injury in which the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor;
- Incident resulting in property damage over USD\$500 as determined by the Company;
- Injury on or in Company Property/Workplace (to Employee or third parties) involving the Employee's use of heavy machinery as determined by the Company;
- Incident considered to be a serious near-miss injury that occurs in the field or in the office as determined by the Company and where the Company reasonably believes (under the Reasonable Suspicion provisions in the Policy) that drug and/or alcohol use is a contributing factor to the serious near miss injury;
- Other circumstances as dictated by Employee Relations; or
- An Employee contributes to any of the above.

Except in emergencies, the employee must remain available for testing. Failure to remain available will be considered as a refusal to submit to the testing, which will result in disciplinary action. Following the test, if there is no reasonable suspicion, the Employee returns to work. The employee will not be allowed to operate any company vehicle or company equipment, or work in any designated areas, pending the result of the drug and/or alcohol test.

Employees who are required to submit to reasonable suspicion testing are prohibited from transporting themselves to or from the collection site. The supervisor will arrange for transportation; the employee will be transported by a CH2M HILL staff member. The employee must remain under the direct observation of the supervisor until turned over to the transporter. The employee will not be allowed to eat or drink unless instructed by the collector as this

may hinder or decrease the company's ability to obtain a valid sample once the drug and/or alcohol test is administered.

After returning from the collection site, the employee must make arrangements to be transported home or to his/her residence. Supervisors must contact local authorities if an employee insists on driving a vehicle. Pending receipt of the drug and alcohol test results, the employee may not return to work.

18.5 Drug and Alcohol Testing for Subcontractors

The drug and alcohol testing requirements stated above apply to subcontractors when required by the subcontract.

18.6 HITS System and Incident Report Form

CH2M HILL maintains a HITS entry and/or Incident Report Form (IRF) for all work-related injuries and illnesses sustained by its employees in accordance with recordkeeping and insurance requirements. A HITS entry and/or IRF will also be maintained for other incidents (property damage, fire or explosion, spill, release, potential violation, and near misses) as part of our loss prevention and risk reduction initiative.

The SC shall complete an entry into the Hours and Incident Tracking System (HITS) database system located on CH2M HILL's Virtual Office (or if VO not available, use the hard copy Incident Report Form and Root Cause Analysis Form and forward it to the RHSM) within 24 hours and finalize those forms within 3 calendar days.

18.7 Injury Management/Return-to-Work (for U.S./Canada/Puerto Rico based CH2M HILL Staff Only)

(Reference CH2M HILL, SOP HSE-124, Injury Management/Return-to-Work)

18.7.1 Background

The Injury Management Program has been established to provide orderly, effective and timely medical treatment and return-to-work transition for an employee who sustains a work-related injury or illness. It also provides guidance and assistance with obtaining appropriate treatment to aid recovery, keep supervisors informed of employee status, and to quickly report and investigate work-related injury/illnesses to prevent recurrence.

To implement the Injury Management/Return-to-Work Program successfully, supervisors and/or SC should:

- Ensure employees are informed of the Injury Management/Return-to-Work Program;
- Become familiar with the Notification Process (detailed below); and
- Post the Injury Management/Return-to-Work Notification Poster.

18.7.2 The Injury Management/Return-to-Work Notification Process:

- Employee informs their supervisor.
- Employee calls the Injury Management Program toll free number 1-866-893-2514 immediately and speaks with the Occupational Injury Nurse. This number is operable 24 hours per day, 7 days a week. Employees are encouraged to enter this phone number into their cell phones prior to starting field work.
- Supervisor ensures employee immediately calls the Injury Management Program number. Supervisor makes the call with the injured worker or for the injured worker, if needed.
- Nurse assists employee with obtaining appropriate medical treatment, as necessary schedules clinic visit for employee (calls ahead, and assists with any necessary follow up treatment). The supervisor or SC accompanies the employee if a clinic visit is necessary to ensure that employees receive appropriate and timely care.
- Supervisor or SC completes the HITS entry or Incident Report Form immediately (within 24 hours) and forwards it to the Project Manager and RHSM.

- Nurse notifies appropriate CH2M HILL staff by e-mail (supervisor, Health & Safety, Human Resources, Workers' Compensation).
- Nurse communicates and coordinates with and for employee on treatment through recovery.
- Supervisor ensures suitable duties are identified and available for injured or ill workers who are determined to be medically fit to return to work on transitional duty (temporary and progressive).
- Supervisor ensures medical limitations prescribed (if any) by physician are followed until the worker is
 released to full duty.

18.8 Serious Incident Reporting Requirements

(Reference CH2M HILL SOP HSE-111, Incident Reporting, Notification and Investigation)

The serious incident reporting requirements ensures timely notification and allows for positive control over flow of information so that the incident is handled effectively, efficiently, and in conjunction with appropriate corporate entities. This standard notification process integrates Health, Safety, Security and Environment and Firm Wide Security Operations requirements for the consistent reporting of and managing of serious events throughout our operations.

18.8.1 Serious Incident Determination

The following are general criteria for determining whether an incident on CH2M HILL owned or managed facilities or program sites is considered serious and must be immediately reported up to Group President level through the reporting/notification process:

- Work related death, or life threatening injury or illness of a CH2M HILL employee, subcontractor, or member of the public;
- Kidnap or missing person;
- Acts or threats of terrorism;
- Event that involves a fire, explosion, or property damage that requires a site evacuation or is estimated to result in greater than \$ 500,000 in damage; or
- Spill or release of hazardous materials or substances that involves a significant threat of imminent harm to site workers, neighboring facilities, the community or the environment.

18.8.2 Serious Incident Reporting

If an incident meets the "Serious Incident" criteria, the Project Manager is to immediately contact the Crisis Manager at 720-286-4911, then follow the standard incident reporting procedure.

For all serious incidents this standard reporting process is implemented immediately so as to ultimately achieve notification to the Business Group President within 2 hours of incident onset or discovery, and notification to appropriate corporate Crisis Management Support Team.

18.9 Incident Root Cause Analysis

The incident analysis is essential if all causes of the incident are to be identified for the correct remedial actions to be taken to prevent the same and similar type of incident from recurring. Root Cause Analysis (RCA) shall be completed for all recordable injuries, property damage incidents in excess of \$5,000.00 (U.S.), environmental permit violations, spills and releases which are required to be reported to regulatory agencies, and any other incident, including near misses where they RHSM or PM determines an RCA is appropriate. The RHSM/REM is responsible for ensuring it is completed and results entered in the incident report form in HITS. RCA's must be completed using a Team that includes, at least the RHSM or designee, the involved party(ies), a responsible operations representative (e.g., PM, construction manager, crew supervisor, etc.) and an independent management representative not associated with the incident.

The Root Cause Analysis Form must be completed for all Loss Incidents and Near Loss Incidents. This form must be submitted to the investigation team for review.

For minor losses or near losses, the information may be gathered by the supervisor or other personnel immediately following the loss. Based on the complexity of the situation, this information may be all that is necessary to enable the investigation team to analyze the loss, determine the root cause, and develop recommendations. More complex situations may require the investigation team to revisit the loss site or re-interview key witnesses to obtain answers to questions that may arise during the investigation process.

Photographs or videotapes of the scene and damaged equipment should be taken from all sides and from various distances. This point is especially important when the investigation team will not be able to review the loss scene.

The investigation team must follow the Root Cause Analysis Flow Chart (see Attachment 4 of the SOP) to assist in identifying the root cause(s) of a loss. Any loss may have one or more root causes and contributing factors. The root cause is the primary or immediate cause of the incident, while a contributing factor is a condition or event that contributes to the incident happening, but is not the primary cause of the incident. Root causes and contributing factors that relate to the person involved in the loss, his or her peers, or the supervisor should be referred to as "personal factors." Causes that pertain to the system within which the loss or injury occurred should be referred to as "job factors."

Personal factors include:

- Lack of skill or knowledge;
- Correct way takes more time and/or requires more effort;
- Short-cutting standard procedures is positively reinforced or tolerated; or
- Person thinks there is no personal benefit to always doing the job according to standards.

Job Factors include:

- Lack of or inadequate operational procedures or work standards;
- Inadequate communication of expectations regarding procedures or standards; or
- Inadequate tools or equipment.

The root cause(s) could be any one or a combination of these seven possibilities or some other uncontrollable factor. In the vast majority of losses, the root cause is very much related to one or more of these seven factors. Uncontrollable factors should be used rarely and only after a thorough review eliminates all seven other factors.

18.9.1 Corrective Actions

Include all corrective actions taken or those that should be taken to prevent recurrence of the incident. Include the specific actions to be taken, the employer and personnel responsible for implementing the actions, and a timeframe for completion. Be sure the corrective actions address the causes.

Once the investigation report has been completed, the PM shall hold a review meeting to discuss the incident and provide recommendations. The responsible supervisors shall be assigned to carry out the recommendations, and shall inform the SC upon successful implementation of all recommended actions.

- Evaluation and follow-up of the IRF will be completed by the type of incident by the RHSM, EM, or FWSO.
- Incident investigations must be initiated and completed as soon as possible but no later than 72 hours after the incident.

19. Records and Reports

An organized project filing system is essential for good documentation and recordkeeping. There are many benefits to an organized filing system:

- Other CH2M HILL employees can easily and quickly find documents;
- Records are readily available for review;
- Records may be needed during OSHA investigations, audits, or other legal matters;
- Records may be needed on short notice in case of an injury, illness or other emergency; and
- Systematic recordkeeping aids in overall project organization.

The project filing system shall be established at the beginning of the project and maintained throughout all phases of construction and archived in accordance with CH2M HILL's Records Retention Policy. The information contained in the filing system shall be updated regularly and/or as specified in this document. The PM and SC are responsible for collecting documentation, including subcontractor documentation, and maintaining a complete and organized filing system.

Below are examples of records that must be maintained as the project progresses:

- Exposure records includes air monitoring data (including calibration records), SDSs, exposure modeling results;
- Physical hazard exposure records include noise, ionizing radiation, non-ionizing radiation, vibration, and lasers exposure assessments and measurements;
- Respiratory fit test records;
- Training records;
- Incident reports, investigations and associated back-up information such as agency notifications, calculations, and corrective actions taken;
- Federal or state agency inspection records;
- Waste analytical data;
- Waste profiles;
- Manifests;
- Permit inspection records;
- Agency submittals and reports;
- Certifications [such as Notice(s) of Intent, state-required erosion and sediment control inspector certifications, Stormwater Pollution Prevention Plan (if permit requires certification), and discharge, wastewater, and monitoring data];
- Other Records:
 - Ergonomic evaluations;
 - HSE audits and assessments;
 - Project-specific HSE plans;
 - Confined space entry permits;
 - Equipment inspections;

- Equipment maintenance;
- Emergency equipment inspection records;
- SBOs;
- Self-assessment checklists
- The RHSM shall coordinate with the PM or designee to ensure that final project-specific HSE records described in this section, including negative exposure determinations, are maintained with the project files in accordance with the CH2M HILL records retention schedule, or forwarded to the Medical Surveillance Program Administrator, as appropriate. Records retention requirements are detailed in the Recordkeeping and Access to Records SOP, HSE-119.

CH2M HILL Employee Sign-Off

I hereby acknowledge that I have received, read, understand, and will comply with this Handbook.

Name (printed):_____

Signature: ______

Employee Number (GEN):_____

Date:_____

Make a photo copy or scan and send this completed sign-off page to your CH2M HILL Safety Program Assistant (SPA).

Subcontractor Sign-Off

E&NBG HSE HANDBOOK

The CH2M HILL subcontractors listed below have been provided with this Handbook, have read and understand it, and agree to abide by its provisions.

This sign-off sheet shall be maintained with the project safety plan.

Project Name:	Project Nu	mber:	
EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

CH2M HILL Health and Safety Plan Attachment 2

Chemical Inventory/Register Form

CH2MHILL

CHEMICAL INVENTORY/REGISTER FORM

Refer to SOP HSE-107, Attachment 1, for instructions on completing this form.

Location:			
HCC:			
Office	Warehouse	Laboratory	Project:
Project No.:			

Regulated Product	Location	Container labeled (✓if yes)	MSDS available (✓if yes)

MSDS for the listed products will be maintained at:

CH2M HILL Health and Safety Plan Attachment 3

Chemical-Specific Training Form

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Refer to SOP HSE-107 Attachment 1 for instructions on completing this form.

Location:	Project # :	
HCC:	Trainer:	

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

Physical and health hazards

Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

CH2M HILL Health and Safety Plan Attachment 4

Project Activity Self-Assessment Checklists/Permits/Forms

Biological Safety Crane Safety Drilling Safety Electrical Safety Earthmoving Equipment Forklift Safety Hand and Power Tools Hazardous Materials Handling Heat stress physiological monitoring form LO/TO Manual Lifting Personal Protective Equipment

HS&E Self-Assessment Checklist—Biological Prevention Measures **CH2M**HILL

HS&E Self-Assessment Checklist

This checklist shall be used by personnel and shall be completed by each crew entering the work area at the frequency of one per day or otherwise specified in the project's Health and Safety Plan/Field Safety Instruction (HSP/FSI). The checklist should be completed prior to entry and at the end of the day to document that appropriate checks have been completed.

This checklist is to be used at locations where the possibility exists that contact with biological hazards is possible.

Site Safety Coordinator (SSC) will request any CH2M HILL subcontractor to take necessary precautions in eliminating the exposure to biological hazards, but shall not direct the means and methods.

Project Name:	Project No.:		
Location:		PM:	
Auditor:	Title: Date:		

- Check "Yes" if an assessment item is complete or correct.
- Check "No" if an item is incomplete or deficient. Section 2 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

	SECTION 1 – PRE-ENTRY	Yes	No	N/A N/O
SIT	E HAZARD EVALUATION			
1. 2. 3. 4. 5.	Inform field members of hazards (types, symptoms) Can work be completed without entering the work zone Have controls been implemented where possible (clearing vegetation, spraying) Has an inspection been made to identify nests, hives or areas where insects may concentrate Will working at different time will reduce exposure			
SE	NSATIVITIES			
6. 7. 8.	Does any staff have existing reactions to stings or bites If yes to #6, is special required and medication available on site (epi-pen) Has anyone with an existing condition briefed other team members about symptoms and first aid which may be required			
EM	IERGENCY RESPONSE			
9. 10. 11. 12. 13.	Are first aid kits, along with tick removal kits, readily available to all staff Does each member of the field staff have ability to communicate (phone, radios, and visual) Are emergency contacts available (base emergency, local police, or local EMT If working in remote areas, is transport readily available (less than 5 minutes) Have you planned an emergency exit from the site in the event of a swarm			

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HS&E Self-Assessment Checklist: BIOLOGICAL PREVENTION MEASURES

Page 2 of 3

	SECTION 2 - PPE	Yes	No	N/A N/O
SELECTION OF PPE				
 14. Will weather (heat, rain, ice) impact the saf 15. Will visibility be limited to unacceptable le 16. Will the use of equipment be difficult if a s 17. Will heavy vegetation be encountered that a 18. Will a Bug-Out suit or Tyvek suit be used be additional rationale in writing in Section 4) 	Yety of workers wearing protective suits evels if a hood is worn uit is worn could rip or damage a suit by staff (if not, please give			
 TYPE OF PPE USED OTHER THAN BUG- 19. Is staff wearing light-colored clothes 20. Is staff wearing long sleeve shirts 21. Are pant legs tucked into socks 22. Are shirts tucked into pants 23. Has tape been placed around sock/pant leg 24. Have hand and wrist areas been sealed 25. Are hats being worn 26. Have clothes been pre treated with Permeth 27. Has team member inspected coworker's su spaces exist for insects to penetrate 	OUT OR TYVEK SUIT line and around waist nrin its or clothing to ensure no			

SECTION 3 – CHECKS AND DECONTAMINATION	Yes	No	<u>N/A N/O</u>
DAILY CHECKS (TO BE COMPLETED DURING AND AT END OF DAY)			
 28. Were tick/insect checks performed during the day (if not, please provide reason in Section 4) 29. Was one unclothed tick check completed 30. Were ticks found on the outerwear (if yes, please note the number in Section 4) 31. Were ticks found inside the Bug-Out, Tyvek, or personal clothing 32. Were suits turned inside out and inspected prior to putting away 33. Were showers taken by field staff immediately upon arrive from the field 34. Were clothing placed in a garbage bag and sealed to prevent any insects from spreading 35. If ticks were found embedding in skin, were they properly removed and saved 36. Have vehicles been inspected for ticks on a daily basis and before the vehicle is turned in 			
REPORTING			
37. If a tick was found on your skin, could you tell where it entered so that it could be addressed 38. If a tick was found embedded, did you contact the PM, complete a HITS form and			
 30. If a tick was found embedded, the you contact the FM, complete a HTTS form and contact the Occupational Physician at 1-866-893-2514 39. Did you contact field staff on the project to provide potential corrective measures 40. Did you follow the IM/PTW procedure to ensure you received the proper. 			
medical attention (if not, provide an explanation in Section 4)			

HS&E Self-Assessment Checklist: BIOLOGICAL PREVENTION MEASURES Page 3 of 3

	*	Corrected (either
m	Rationale	next day or intended on future projects)

Auditor: _____ Project Manager: _____

CH2MHILL.

Attachment 1: Subcontractor Safety Procedure Criteria-Cranes

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate development and review of subcontractor crane procedures. Subcontractors are expected to address the following items in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Cranes Safety Procedures:

- 1. Provide documentation of training for crew and operator for hazards associated with electrical contact with a power lines.
- 2. Provide documentation of training certification for all employees authorized to perform hand signals.
- 3. Provide name and qualification (years and type of experience, training background, etc.) of all qualified riggers assigned to project.
- 4. Provide the name and qualifications (years and type of experience, training background, knowledge of OSHA Cranes standard, etc.) of any and all crane operators. After November 10, 2014 certification from an accredited testing organization or audited employer program, the US Military or State/local license will only be accepted.
- 5. Provide the name and qualifications of the Assembly/Disassembly Director.
- 6. Describe how crane Assembly/Disassembly procedures are communicated to crew and documented.
- 7. If any work is to be conducted within 20ft of energized power lines, provide the encroachment preventative measures to be taken to ensure worker safety from electrocution.
- 8. Describe how workers are trained on the hazards they face while working on and around crane operations.
- 9. Provide a description of cranes inspection criteria or procedures (frequency of inspections, documentation, items that are inspected).
- 10. Provide a list of work areas and activities where cranes will be performed.
- 11. Describe safe work practice guidelines on in use and the limitations for each type of crane to be used.
- 12. Describe criteria for crane usage during adverse weather conditions and how weather monitoring will occur.
- 13. Describe criteria for critical lifts requiring a written lifting and rigging plan. As a minimum, the written plan shall contain the following: critical concerns of the lift; type of crane to be used; crane location; boom angle; radius; weight of the load; dimensions of the load; attachment of points for rigging; obstructions in the path of the load; rigging hardware; operator's qualifications; and other equipment or cranes to be used in the lift.

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Attachment 2: Crane Operator's Qualification and Crane **Operation Guidelines**

GENERAL

All crane operators must follow these procedures. These guidelines must be considered the minimally acceptable standards for operation. When a crane is maintained and used properly, it can be a safe, highly useful piece of equipment; but if not used properly, it can be dangerous.

Think safety. The operator is in charge of an important piece of equipment and must be aware of what it can do and what it should not do. No set of instructions can anticipate all the situations an operator might experience. These guidelines cover general usage and some of the more specific cases. If conditions arise which are not covered by these guidelines, the operator should consult the operator's supervisor or the crane manufacturer. One telephone call may save someone's life.

Operator Qualifications

GENERAL

- 1. Cranes shall be operated only by the following personnel:
 - a. Designated operators
 - b. Learners, while under the direct supervision of a designated operator
 - c. Maintenance and test personnel, when necessary in the performance of their duties
 - d. Inspectors
- 2. No one, other than personnel specified above, shall enter a crane cab with the exception of persons such as helpers and supervisors whose duties require them to do so, and then only in the performance of their duties and with the knowledge of the operator or other appointed person.
- 3. Operators shall be required by the employer to pass a written and/or oral examination and a practical operating examination, unless able to furnish other satisfactory evidence of qualifications and experience. Qualifications shall be limited to the specific type of equipment for which examined.
- 4. Operators and/or operator trainees shall meet the following physical qualifications:
 - Have vision of at least 20/30 Snellen in one eye and 20/50 in the other with or a. without glasses.
 - b. Be able to distinguish red, green, and yellow regardless of position of colors, if color differential is required for operation.
 - Hearing, with or without hearing aid, must be adequate for a specific operation. c. Have sufficient strength, endurance, agility, coordination, and speed of reaction to meet the demands of equipment operation.
 - Show no evidence of physical defects or emotional instability which could render e. the operator a hazard to self or others; or which, in the opinion of the examiner, ¹ could interfere with the operator's safe performance. The existence of any such

¹ An Examiner is defined as one who is licensed to practice medicine by the state or a physician who is certified by The American Board of Medical Specialties. HSE-303 VERSION 2 - A2

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evidence may be sufficient cause for disqualification. In such cases specialized clinical or medical judgments and tests may be required.

- f. Show no evidence that an operator is subject to seizures or loss of physical control; the existence of such evidence may be sufficient cause for disqualification. Specialized medical tests may be required to determine these conditions.
- g. Have good depth perception, field of vision, reaction time, manual dexterity, coordination, and no tendencies to dizziness or similar undesirable characteristics.

Crane Operator's Guidelines

OPERATING PRACTICES

- 1. Operators shall not engage in any practice that could divert attention while actually engaged in operating the crane.
- 2. Operators shall not operate this equipment if physically or mentally unfit.
- 3. Operators shall respond to signals only from the appointed signal person but shall obey a stop signal at any time, regardless of who gives it.
- 4. Operators shall be responsible for those operations under their direct control. Whenever there is any doubt as to safety, the operator shall have the authority to stop and refuse to handle loads until safety has been assured.
- 5. If a warning signal is furnished, it shall be sounded each time before traveling, and intermittently during travel, particularly when approaching workers.
- 6. Before leaving the crane unattended, the operator shall:
 - a. Land any suspended load.
 - b. Disconnect power.
 - c. Set trolley brakes and other locking devices, and bring hook block to highest position.
 - d. Put controls in the "OFF" position.
 - e. Secure crane against accidental travel.
 - f. When wind alarm is given or on leaving crane overnight, rail clamps, where provided, shall be set.
- 7. Release swing brake to allow weather-vaning unless 360 degrees rotation is not possible. Where the crane must be restrained from swinging freely, the manufacturer's recommendation should be followed.
- 8. If there is a warning sign on the disconnecting means or starting controls, the operator shall not close the circuit or start the motor until the warning sign has been removed by an appointed person.
- 9. Before closing the disconnecting switch, the operator shall see that all controls are in the "OFF" position and all personnel are clear.
- 10. If power fails during operation, the operator shall:
 - a. Set travel, hoist, and trolley brakes and other locking devices.
 - b. Move all controls to the "OFF" position.
 - c. If practical, land the suspended load under brake control.

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- 11. Operators shall familiarize themselves with the equipment and its care. If adjustments or repairs are necessary or if any damage becomes known, the operator should report the same promptly to the appointed person and shall also notify the next operator upon changing shifts.
- 12. <u>All controls shall be tested by the operator at the start of the new shift</u>. Any controls that do not operate properly must be adjusted or repaired before operations are begun.
- 13. Cranes shall not be operated when wind speed exceeds maximum velocities recommended by the manufacturer.
- 14. Cranes shall not be raised to a new operating level above the structure when the wind speed exceeds 20 miles per hour (32.2 km/hr), or lower velocities if so recommended by the manufacturer.
 - a. In regions where winds are gusty or velocities changeable, means should be provided to preserve the crane stability in case the wind velocity rises above the recommended limits for climbing operations.
 - b. The crane operator shall be present during all climbing operations.
- 15. Where a floor of a structure is used as the supporting basis for a crane, a qualified person shall determine the load-bearing ability of the floor and recommend such shoring as may be necessary.
- 16. Operations during climatic conditions that produce icing of the crane structure or reduced visibility should be undertaken only in accordance with the crane manufacturer's recommendations for such conditions.
- 17. Where night operations are carried out, lighting shall adequately illuminate working areas while not interfering with the operator's vision.
- 18. Crane riggers shall be used, regardless of the size or weight of the load to be lifted. Extend the beams fully and retract the wheels off the ground.

HANDLING THE LOAD

- 1. Size of load
 - a. No crane shall be loaded beyond the rated load capacity except for test purposes.
 - b. The person directing the hoisting operation shall ascertain that the weight of a load approaching rated capacity has been determined within 10 percent before it is hoisted and shall so notify the operator.
 - c. Rated load capacities, recommended operating speeds, and special hazard warnings or instructions are to be posted on cars and platforms.
- 2. Attaching the load
 - a. The hoist rope shall not be wrapped around the load.
 - b. The load shall be attached to the hook by means of slings or other approved devices.
- 3. Moving the load
 - a. The individual directing the hoisting operation shall see that:
 - (1) The hoist rope is not kinked.

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- (2)The load is secured and balanced in the sling or hoisting device before it is hoisted more than a few inches.
- b. Before starting the hoist, note the following conditions:
 - The hoist rope shall not be kinked. (1)
 - (2) Multiple part lines shall not be twisted around each other.
 - (3) The hook shall be brought over the load in such a manner as to minimize swinging.
 - (4)If there is a slack rope condition, it should be determined that the rope is seated on the drum and in the sheaves.
- During the hoisting, care shall be taken that: c.
 - (1)There is no sudden acceleration or deceleration of the moving load.
 - (2)The load does not contact any obstructions.
- Side loading of booms shall be limited to freely suspended loads. Cranes shall not d. be used for dragging loads sideways.
- The operator shall not hoist, lower, swing, or travel while anyone is on the load or e. the hook.
- f. The operator should not move loads over people.
- The operator shall test the brakes each time a load approaching the rated load is g. handled by raising the load a few inches and applying the brakes.
- h. The load shall not be lowered below the point where less than two full wraps of rope remains on the drum.
- i. When rotating the jib, running the trolley, or traveling the crane, sudden starts and stops shall be avoided. Rotational and travel speeds shall be such that the load does not swing out beyond the radius at which it can be controlled. A tag or restraint line shall be used when movement of the load is hazardous.
- 4. Holding the load
 - The operator shall not leave the required position at the controls while the load is a. suspended.
 - No person should be permitted to stand or pass under a load on the hook. b.

MISCELLANEOUS

- 1. Signals
 - Standard signals to the operator shall be used in accordance with those prescribed a. unless voice communication equipment (telephone, radio, or equivalent) is used. Signals shall be discernible or audible at all times. No crane motion shall be made unless signals are clearly understood.
 - b. Appropriate standard hand signals shall be conspicuously posted.
 - Special signals may be necessary for some operations or by special conditions that c. occur from time to time. In such cases, additions to or modifications of the standard signals may be required. Special signals shall be agreed on in advance by the operator and the signal person and must not conflict with standard signals.
 - d. Instructions, which must be given to the operator other than those provided by the established signal system, shall be given after the motion of the crane is stopped.

- 2. Rail clamps, when used, should have some slack between the point of attachment to the rail and the end fastened to the crane. Rail clamps shall not be used as a means of restraining tipping of a crane.
- 3. The manufacturer's specified ballast or counterweight specified shall be in place when cranes are operated. The specified amount shall not be exceeded.
- 4. Operating near electric power lines
 - a. Except where the electrical distribution and transmission lines have been deenergized and visibly grounded at the point of work, or where insulating barriers which are not a part of or an attachment to the crane have been erected to prevent physical contact with the lines, cranes shall be operated proximate to, under, over, by, or near power lines only in accordance with the following:
 - (1) For lines rated 50 KV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet (3.05 M).
 - (2) For lines rated over 50 KV minimum, clearance between the lines and any part of the crane or load shall be 10 feet (3.05 M) plus 0.4 inch (10.2 mm) for each 1 KV over 50 KV; or use twice the length of the line insulator but never less than 10 feet (3.05 M).
 - (3) A person shall be designated to observe the clearance and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.
 - (4) Each operator will be required to read and sign a <u>Crane Operator's Safety</u> <u>Checklist</u> (Exhibit 23-1). A copy of this checklist will be put in the operator's personnel file.
 - b. Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements even if such devices are required by law or regulation.
 - c. Before commencing operation near electrical lines, the person responsible for the job shall notify the client or the client's authorized representative of the lines. Such persons will be provided with all pertinent information and will be requested to cooperate.
 - d. Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electric utility authority indicates that it is not an energized line.
 - e. Exceptions to this procedure, if approved by the client of the electrical lines, may be granted by the administrative or regulatory authority if the alternate procedures provide sufficient protection and are set forth in writing.
- 6. Cabs
 - a. Personal belongings, including necessary clothing shall be stored in such a manner as not to interfere with access or operation.
 - b. Tools, oil cans, extra fuses, and other necessary articles shall be stored in the toolbox and not lie loose in or about the cab.
- 7. Fire extinguishers
 - a. A 5# BC, carbon dioxide, dry chemical, or equivalent fire extinguisher shall be kept in the cab.

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- b. Operating and maintenance personnel shall be familiar with the use and care of fire extinguishers provided.
- 8. Signs

Safety instruction signs are to be white and the principle message should be on a green upper panel with white lettering. Any additional wording on the sign should be in black letters on a white background.

- 9. Operating Rules and Notices
 - a. Established operating rules are to be posted on the operator's hoist station.
 - b. Operating rules are to include signal system and allowable line speed for various loads.
 - c. Rules and Notices should also be posted on the car frame or crosshead in a conspicuous location and should read "No Riders Allowed".

There are numerous safety requirements in this procedure. These items are not intended as a complete set of safety instructions to cover all possible situations that may arise. All operators, if faced with a situation for which they are unsure as to how to proceed, are to check with their supervisors before proceeding.

CRANE OPERATOR'S SAFETY CHECKLIST

- 1. Read the operator's manual and heed it.
- 2. Do not eat, read, or otherwise divert your attention while operating a machine.
- 3. Regardless of the size or weight of the load to be lifted, use the crane's outriggers. Extend the beams fully and retract the wheels off the ground.
- 4. Do not allow crane loads, buckets, etc. to pass over people or endanger their safety.
- 5. Do not allow anyone to ride on the hook, block, bucket, etc.
- 6. Be sure your work area is clear.
- 7. Inspect your machine daily. Do not operate a damaged or poorly maintained machine.
- 8. Do not allow the load or bucket to strike the boom. Do not allow the boom to rest on or strike a building or any other object.
- 9. Always wear personnel protective equipment required by local and job regulations.
- 10. Never get on or off a machine that is moving.
- 11. Keep a dry chemical fire extinguisher of 5 B:C rating or larger in the cab or in the immediate vicinity of the machine at all times.
- 12. Never tamper with safety devices.
- 13. Do not smoke when fueling, or refuel near an open flame.
- 14. Keep fingers, feet, and clothing away from sheaves, drums, and ropes unless the machine is shut down.
- 15. When checking battery level, use a flashlight, not an open flame.
- 16. When working inside a building, check clearances to avoid a collision.
- 17. Use extreme caution when removing radiator caps, drain plugs, grease fittings, hydraulic pressure caps, etc.
- 18. All electrical power lines are dangerous. Contact with them, whether insulated or not, can cause death or injury.
- 19. For electrical service lines rated 50 KV or less, the minimum safe distance is 10 feet. For lines rated 50 KV or greater, loads must be 10 feet plus 0.4 inch for each 1 KV over 50 KV or twice the length of the line insulator, but never less than 10 feet.
- 20. Assume that every line is "hot."
- 21. What do you do if a power line is touched by a machine or load?
 - a. Keep cool. Think. A mistake can kill someone.
 - b. Warn all personnel to keep clear.
 - c. If the machine is operable, try to move it away from contact. You, the operator, are reasonably safe in the cab unless the machine is on fire or an arc is cutting through the cab near you.
 - d. Move away from contact in reverse to the movement that caused the contact. Example: If you swing left into a wire, swing to the right to break contact.

Remember - once an arc has been struck, it can stretch out a great distance before it breaks. Keep moving away from the line until the arc breaks.

- When the arc breaks, continue moving until you are at least 15 feet away (or as e. specified by local code). Stop the machine. Thoroughly inspect the machine for damage. Repair any damage before further use.
- f. If you cannot disengage from the line, and the machine is not on fire and no arc is cutting through the cab, remain in your seat until the power line can be shut off.
- If you must leave the machine, do not step off. Leap from the machine as far as g. possible.

Crane Operator's Acknowledgement

I have read and fully understand the "Crane Operator's Safety Checklist," and will abide by these rules.

I have also received a copy of the Crane Operation Guidelines, and have read and understand the contents. I will operate the equipment as outlined in the procedure in a safe and productive manner. Furthermore, I understand that anytime I find anything defective or not operating properly, I will notify my supervisor of the condition(s).

I certify that I am qualified to operate: _____

Number of years experience as a crane operator:

Operator's Signature	Operator	Operator's Name (PLEASE PRINT)	
Witnessed	Project Number	Date	
Supervisor			

Original to file Copy to Operator

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Attachment 3: Daily Crane Inspection Log
DAILY CRANE INSPECTION LOG

WEEK OF:	VEEK OF: EQUIPMENT #			_ MODEL					
TTEM		CUN	MON	THE	MED	TIII	EDI	CAT	
OPERATORS DAILY CHECK LIST		501	MON	TUE			FNI	JAI	
HYDRAULIC OIL LEVEL							_	-	
LOOSE PARTS OR DAMAGED								-	
FREE TURNING OF SHEEVES						-			
OIL LEAKS							_	-	
ANGLE INDICATORS					-			+	
I EVEL INDICATORS								-	
ALL CONTROLS								+	
HOLDING VALVE OPERATION								+	
ALL HYD. HOSES						-			
PARKING BRAKE OPERATION						-			
ANTI-TWO BLOCK SYSTEM								-	
CAPACITY ALERT SYSTEM									
CONDITION OF LOAD LINE									
WINCH BRAKE OPERATION									
HOOK SAFETY LAYCH									
CORRECT ROPE REEVING									
SAFETY EQUIPMENT									
BACK UP ALARM									
LOAD CHART									
WARNING SIGNS									
SWING RADIUS BARRICADED									
(2) 5LB (40bc) FIRE EXTINGUISHE	R								
OPERATING INSTRUCTIONS									
ALL LIGHTS									
ALL FLUID LEVELS									
OPERATORS									
INITIALS									

IF ANY ITEM IS FAULTY, USE REMARK SECTION

LUBRICATION POINTS REQUIRED BY LUBE CHART						OK
IS CRANE READY FOR SERVICE	YES	NO	TAGGED OUT	YES	NO	DATE/TIME

OPERATOR		DATE
ALL FAULTY ITEMS REPAIRED _	· · · · · · · · · · · · · · · · · · ·	DATE
COMPANY/ SUBCONTRACTOR		

Note to be performed on a daily basis.

This list is not intended to replace the manual. Any deficiencies shall be carefully examined and a determination made as to whether or not they constitute a hazard.

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Attachment 4: Hook Inspection Log

HOOK INSPECTION LOG

Date:

Crane Make:

Serial No.:

Main Hoist Capacity:

Aux. Hoist Capacity:



Main Hoist Hook

Date:	
Tram Point Measurement A: New Throat Opening B:	
Allowable Throat Opening:	

Auxiliary Hoist Hook

Date:

Tram Point Measurement A:	
New Throat Opening	
B:	

Allowable Throat Opening:

SIGNATURE:

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Attachment 5: Critical Lift Checklist

CH2MHILL[®] CRITICAL LIFT CHECKLIST

1. CRITERIA

- _____ Load exceeds 75% of load chart for crane or derrick
- _____ Two or more cranes/booms required
- _____ Special hoisting/rigging equipment will be utilized
- _____ Weight exceeds 20 tons
- ____ Other (Specify) _____

2. DESCRIPTION OF OBJECT TO BE RAISED _____

3. HOW WEIGHT OF OBJECT WAS OBTAINED

- A. Certified scale weight _____ Ticket # _____
- B. Calculated independently by more than one source
- a). Source______Weight _____

 b). Source ______Weight _____
- C. If lift is an existing item (Being removed or demolished). The weight is to be recalculated, taking into account all modifications including internal, as well as an allowance for scale, sediment, sludge, insulation, liquid, etc.
- a). Source______Weight _____

 b). Source ______Weight _____
- 4. DESCRIPTION & WEIGHT OF ALL RIGGING EQUIPMENT & CRANE ATTACHEMENT DEDUCTIONS FROM LOAD CHARTS. (SEE GUIDE TO DETERMINE LOAD SECTION I).
- 5. TOTAL WEIGHT OF OBJECTS, RIGGING & LOAD CHART DEDUCTIONS. (SEE GUIDE TO DETERMINE LOAD SECTION II).

Source ______ Weight _____

6. EQUIPMENT AND LIFT RELATIONSHIP

- A. Maximum operating radius.______B. Planned operating radius.______C. Allowable load (From load chart).______
- D. Ratio of lift to allowable load.E. Clearance between boom & lift.
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7. MAIN FALL: Load block size.		F. Clearance to surrounding facilities.G. Clear path for load movement.	
Load block size.	7.	MAIN FALL:	
Load chart #	Loa Nu Per Wh	nd block size. mber of parts of line. missible line pull. ipline capacity.	
Total load to be handled.		Load chart # Chart Capacity @ rad	ius
 8. HAS ALL LIFTING EQUIPMENT AND RIGGING BEEN INSPECTED AND FOUND IN ACCEPTABLE CONDITION FOR THIS LIFT	Tot Inc	al load to be handled. ludes all blocks, slings, attachment balls, auxiliary equipment load. (See guide to determine load).	and items that are considered as
 9. STABILITY OF GROUND AREA A. Soil bearing capacitySource	8.	HAS ALL LIFTING EQUIPMENT AND RIGGING BEEN INS ACCEPTABLE CONDITION FOR THIS LIFT.	SPECTED AND FOUND IN
A. Soil bearing capacity	9.	STABILITY OF GROUND AREA	
 10. WILL A WRITTEN LIFT PLAN & LIFT DRAWINGS BE REQUIRED FOR THIS LIFT?. 11. TYPE OF COMMUNICATIONS TO BE UTILIZED AND SPECIFIC RESPONSIBILITIES COMMUNICATIORS. 12. WHAT ARE WIND & WEATHER RESTRICTIONS. 13. HOW WILL LIFT AREA BE KEPT CLEAR OF UNNECESSARY PERSONNEL 14. ANY SPECIAL CONDITIONS THAT LIFT PERSONNEL NEED TO BE AWARE OF 		 A. Soil bearing capacity Source B. Are mats required Size & number C. Any underground installations need special treatment D. Ratio of soil bearing capacity to actual 	
11. TYPE OF COMMUNICATIONS TO BE UTILIZED AND SPECIFIC RESPONSIBILITIES C 12. WHAT ARE WIND & WEATHER RESTRICTIONS	10.	WILL A WRITTEN LIFT PLAN & LIFT DRAWINGS BE REQ	UIRED FOR THIS LIFT?.
12. WHAT ARE WIND & WEATHER RESTRICTIONS. 13. HOW WILL LIFT AREA BE KEPT CLEAR OF UNNECESSARY PERSONNEL 14. ANY SPECIAL CONDITIONS THAT LIFT PERSONNEL NEED TO BE AWARE OF	11.	TYPE OF COMMUNICATIONS TO BE UTILIZED AND SPE COMMUNICATIORS.	CIFIC RESPONSIBILITIES OF
13. HOW WILL LIFT AREA BE KEPT CLEAR OF UNNECESSARY PERSONNEL 14. ANY SPECIAL CONDITIONS THAT LIFT PERSONNEL NEED TO BE AWARE OF	12.	WHAT ARE WIND & WEATHER RESTRICTIONS.	
14. ANY SPECIAL CONDITIONS THAT LIFT PERSONNEL NEED TO BE AWARE OF	13.	HOW WILL LIFT AREA BE KEPT CLEAR OF UNNECESSA	RY PERSONNEL
	14.	ANY SPECIAL CONDITIONS THAT LIFT PERSONNEL NE	ED TO BE AWARE OF

CRITICAL LIFT APPROVALS

1. COMPANY SUPERVISOR

Name Printed

Name Signed

2. CONTRACTOR SUPERVISOR

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Name Printed

Name Signed

3. SIGNAL PERSON

Name Printed

Name Signed

4. CRANE OPERATOR

Name Printed

Name Signed

5. PROJECT ENGINEER

Name Printed

Name Signed

DON'T FORGET THE LAW OF GRAVITY!!!

Attachment 6: Critical Lift Permit

CH2MHILL CRITICAL LIFT PERMIT

Secti	on 1 -	Lift Summary							
Job/	Work	Order:	Unit/Area:]	Date:	Time:		
Obje	ct Beiı	ng Lifted:							
Lift I	Descri	ption (Pick to Set Up):							
		· · · · ·							
Secti	on 2 -	<u>- Pre-Lift Plan (Initial Each Space)</u>	Y N	В.	Slings &	Shackles			
1.	Equi	pment inventory completed?			1. Slin	ng Selectior	L		
2.	Wea	ther conditions been considered?			а	Type of A	rrangement		
3.	PTP	conducted?			u. Ve	ui col	Paaleat	Chalad	
4.	Safe	rigging practices implemented?			ve		Dasket	Спокеа	
5	deter	mined?			b.	Number	of Slings in Hook-U	Jp	
6.	Liftin	ng lugs engineered to specifications?			c.	Sling Loa	ıd		lbs
7.	Matt	ing inspected and approved?			d.	Sling Size	e/Capacity (SWL)		lbs
8.	Stabi	lity of the ground been assured?			2. Sha	ackle Select	ion		-
9.	Tag	ine to be used?				Stock Dir	motor		in
	Coni	necting/disconnecting means			a. 1		linetei		
10.	deter	rmined?			b.	Capacity			tons
11.	Orie	ev equipment required?		C	Tailing (rane			
13	Pre-l	ift meeting held?		C.	1 T				
14.	Tota	l weight below 85% of capacity?			1. Iyj	pe of Crane	•		
		0 1 2			2.	Rated Ca	pacity		tons
					3. Lif	ting Arrang	gement		
Secti	on 3 -	 Load & Capacity Calculations 			Ma	ximum Dis	tance, center of		
А.	Weig	ght of Equipment (Live Load)	TT 1		a. loa	d to center	pin of crane		feet
	1.	Equipment Condition New	Used		b. Ler	ngth of Boo	m (feet)		feet
	2. 3	Weight of Attachments	Ibs		c. An	gle of Boon	n at Pick-Up		deg
	э. а.	Platforms and Ladders	lbs		d An	gle of Boon	n at Set		deg
	b.	Piping and Accessories	lbs		0 Cr	oss chart ca	nacity of crano		_ the
	c.	Liquids Inside	lbs		e. Gr				- 105
	d.	Dirt & Debris	lbs		4. Ma	x load on T	ailing Crane		lbs
	e.	Refractory	lbs		Per E he	cent Crane	Capacity (must		0/
	f.	Internal Trays or Liners	lbs		5. De	<05 /0 01 10€	(u capacity chart)		/0
В.	Wt. (Of Crane Accessories			Require	d Attachm	ents		
	(cons	sider those on tailing crane)			1. Pre	-Lift Meeti	ng attendance roste	r	
	1	Weight of headache ball, block,	llha		2. Cra	ane Operato	or certifications		
	1. 2	Weight of Lifting Bar	Ibs		Мо	st recent in	spection report for	each cran	ne, to
	3	Weight of Slings & Shackles	lbs		3 inc	lude type, s	ize, capacity rating	, manufa	cturer,
	0.	Total Weight	lbs		cap	acity certif	icate & hook inspec	tion	
		<u> </u>			doo	umentatio	n 		
Secti	on 4 -	Crane and Rigging Details			4. Co:	mplete rigg	ing diagram		
А.	Erec	tion Crane		Section	on 5 – A	uthorizatio	n Signatures		Date
	1.	Type of Crane:		<u>secu</u>	<u>011 5 - A</u>	umonzam	<u>Il Signatures</u>		Date
	2.	Rated Capacity:	tons						
	3.	Lifting Arrangement		Cran	e Operat	or			
	2	Max distance, center of	foot		-				
	a. b	Length of Boom	feet						
	с.	Angle of Boom @ Pick-up	deg	Com	pany Suj	pervisor			
	d.	Angle of Boom at Set	deg						
		Gross chart capacity of	0	Cont	ractor Su	pervisor			
	e.	crane	lbs			1			
	4.	Net Load on Crane	lbs						
	_	Percent Crane Capacity		Riggi	ing Supe	rvisor			
	5.	(must be <85% of load	0/	Proie	ct Engin	eer			
		capacity chart)	%		0				

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Attachment 7: HSE Self-Assessment Checklist

HSE Self-Assessment Checklist— - CRANES

This checklist shall be used by CH2M HILLCH2M HILL personnel only and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILLCH2M HILL employees are exposed to crane hazards (complete Section 1) and/or (2) CH2M HILLCH2M HILL provides oversight of subcontractor personnel who are exposed to crane hazards (complete entire checklist).

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of crane, hoist and rigging operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Proi	ect Name: Project No.:					
- 10j						
Loc	ation: PM:					
Aud	Auditor: Title: Date:					
This	s specific checklist has been completed to:					
	Evaluate CH2M HILLCH2M HILL employee exposure to crane, hoist and rigging hazards					
	Evaluate a CH2M HILLCH2M HILL subcontractor's compliance with crane, hoist and rigging requirem	ents				
	Subcontractors Name:					
•	Check "Yes" if an assessment item is complete/correct.					
•	Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of	of the su	bcontrac	ctor. Secti	ion 3 must be	
	completed for all items checked "No."					
•	Check "N/A" if an item is not applicable.					
•	Check "N/O" if an item is applicable but was not observed during the assessment.	D		02		
•	Numbers in parentneses indicate where a description of this assessment item can be found in Standard of	Practic	e HSE-3	03.		
	<u>SECTION I</u>	X 7	NI.		N/O	
G		<u>r es</u>	NO	N/A	<u>N/U</u>	
	Ground conditions are firm, drained and graded					
2	Supporting materials (mats, blocking, cribbing, marsh buggies, etc.) being used	H	H	H	H	
3	Underground hazards researched by "Controlling Entity" and communicated with operator	H	H	H	H	
5.	Controlling Entry with continuand the operator					
	SECTION 2					
Ass	embly/Disassembly					
4.	A competent and qualified Assembly/Disassembly (A/D) Director has been assigned					
5.	A/D Director has reviewed and understands either the manufacturer and/or employer procedures					
6.	A/D Director has verified that the crew understands their tasks and hazards associated with A/D					
7.	All A/D crew members in visible line-of-sight of the operator during A/D tasks					
8.	If "No" to #7, is there a pre-determined communication system established prior to maneuvering crane					
9.	Are A/D crew under boom, jib, or other components when pins (or similar) are being removed		Ц			
10.	Have boom sections and boom suspension systems been rigged or supported during pin removal	Ц	Ц	Ц	Ц	
11.	Have rated capacity limits been verified as not to be exceeded on equipment during A/D					
12.	Have suitable points of attachment of rigging to boom and jib been established to prevent damage		H			
13.	Has the center of gravity been established for all loads		H			
14.	when using outriggers, they are fully extended of deployed as per the load chart	H	H	H	H	
15.	Synthetic sings are protected with patients to prevent distortion from sharp, abrasive of acute edges. The Δ/D Director has inspected the grape after assembly and prior to use	H	H	H	H	
17	A/D crew protected from unintentional movement from inadequately supported counterweights	H	H	H	H	
18	The weight of each component is known and readily available	H	H	Н	H	
10		H	H	H	H	

- 19. Reusable shipping pins, straps, links and similar equipment is removed
- 20. Outriggers are fully extended, or if manufacturer procedures permit, deployed as specified on load chart
- 21. The A/D Director has completed a post-assembly inspection
- 22. Equipment used for pile driving must have a jib attachment during pile driving operations
- 23. All rigging work during assembly/disassembly performed by a qualified rigger

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Dam	SECTION 3				
row	er mie sarety (up to 550k v)- Assembly/Disassembly	Yes	No	N/A	<u>N/O</u>
 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 	Is crane, load, and load line >20ft from overhead power lines? (If "Yes" no further action) If "No" to #24, are the power lines de-energized and grounded? (If "Yes" no further action) If "No" to #24 & #25, has the voltage been verified &safe distances found in table A maintained (>10ft) If "No" to #24 & #25, has a planning meeting occurred with A/D crew If "No" to #24 & #25, have elevated warning lines, barricades or signs been placed If "No" to #24 & #25, are proximity alarms, spotters, warning devices or insulated links used Non-conductive tag lines used Intentional operation of crane closer than Table A allowable clearances prohibited- consult RHSM Is there at least two electrocution hazard warnings conspicuously posted outside equipment Is there at least one electrocution hazard warning conspicuously posted in side cab of crane				
	<u>SECTION 4</u>				
Gen	eral				
$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	Individuals operating cranes of any type are qualified or certified operators Cranes have current annual inspection and operations manual with load charts on site Swing radius of cranes are guarded and barricaded Competent person inspects crane daily and weekly Crane ropes and hooks have been inspected by an authorized person Pre-lift meetings conducted with all parties involved in crane operations Cranes used to lift vertically only Adequate distance maintained between cranes parts and overhead power lines (<10ft) Dedicated and qualified signal person assigned to signal operator Cranes do not swing over live roadways, railways, processes, or occupied buildings Critical lifts (>75% load capacity of crane, tandem lift, >20 tons) have written lifting/rigging plan No personnel permitted on or under loads lifted by crane. Tag lines used to control load Manufacturers specifications and limitations for hoists followed Personnel not permitted to ride on material hoists Weather conditions considered when lifting operations performed (winds >25MPH) Air monitoring conducted when combustion engine cranes operated in enclosed spaces All guards and safety devices are installed and equipment removed after maintenance A load-rating chart is easily visible to the seated operator A designated person has been assigned to signal the operator when visibility is obstructed Hand signals to crane operators are those prescribed by ANSI All outriggers are deployed and seated The tires of truck mounted cranes are off the ground when the outriggers are seated Cranes are equipped with a 5 BC or higher fire extinguished All windows in cabs are safety glass that does not interfere with the safe operation All machinery operating on rails, tracks, or trolleys has stops/limiting and overspeed devices Moving parts on the crane that employees are exposed to are guarded Is there at least one electrocution hazerd warning conspicuously posted in cab of crane? Cranes operated near live power lines will maintain minimum distance from the lines Adequa				

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	SECTION 5				
		Yes	No	N/A	<u>N/O</u>
CRA	ANES: OPERATION (5.2.3)				
70.	Manufacturer procedures applicable to equipment & attachments are readily accessible to operator				
71.	Operator not engaged in any other activity that diverts attention while operating equipment				
72.	Equipment not be left unattended while load is suspended				
73.	Equipment is Tagged Out of Service when repair is needed				
74.	Equipment secured per manufacturer recommendations during storm warnings				
75.	Load weight has been verified by operator prior to lift				
76.	Traveling with a load is prohibited				
77.	Operator understands he/she has authority to stop any pick deemed unsafe	Ц	Ц		
78.	Operator tests brakes when load is near rated capacity of lift	Ц	Ц	Ц	
79.	Sheaves are guarded or warning sign provided to identify hazard	Ц	Ц		
80.	Load or boom not lowered to where less than two full wraps of rope remain on drum				
81.	If two or more cranes are to be used to lift one load, a designated person is responsible	_	_	_	_
	for analyzing, instructing, rigging and signaling movement of the load	Ц	Ц	Ц	
82.	Cranes not operated without full amount of ballast or counterweight	H	H	H	Ц
83.	Tag lines are used to control suspended load	H	H		
84.	Sudden acceleration of deceleration of load is avoided	H	H	H	
85.	Loads are not to be passed over personnel or facilities	H	H		
86.	No personnel are allowed to ride the load	H	H		
8/.	Suspended loads are not left unattended	H	H	H	
88.	Lines are not allowed to twist around each other				
	SECTION 6				
Sign	als				
		_	_	_	_
89.	A signal person is provided when the load travel is not in full view of the operator				
90.	A signal person is provided when the crane is traveling, and the view is obstructed	Ц	Ц		
91.	A signal person is provided when there are site specific safety concerns	Ц	Ц	Ц	
92.	Only qualified personnel deliver hand signals to operator	Ц	Ц	Ц	
93.	Only Standard Method signals are used (unless signal person, operator and lift director agree otherwise)	Ц	Ц	Ц	
94.	Hand, voice, audible or new signals are suitable for site conditions	Ц	Ц	Ц	님
95.	Hand signal charts are posted on the equipment or conspicuously posted in the vicinity of hoisting	Ц			
96. 07	when tandem lifts are performed, signal person must identify which crane the signal is for	H	H	H	
97.	when electronic equipment is used for signaling must be tested before beginning operation	H	H	H	
98.	when electronic equipment is used for signaling it must be through a dedicated channel	H	H	H	
99. 100	When electronic equipment is used for signaling, the operators reception must be hands-free				
100.	and agree on what signals will be used and what they mean				
101	and agree on what signals will be used and what they incan	H	H	H	H
101.	Signal person has been quanned unough examination and practical testing				

HSE Self-Assessment Checklist – CRANES

<u>SECTION 3</u>				
Compl	ete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely	manner.		
Item		Date Corrected		
#	Corrective Action Planned/Taken			

Auditor: _____ Project Manager: _____

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Attachment 1: Subcontractor Safety Procedure Criteria - Drilling

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate development and review of subcontractor safety procedures. Subcontractors are expected to address the following items, at a minimum, in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Drilling Safety Procedures:

- 1. Provide name and qualifications of the drilling "competent person" responsible for drilling (years and type of experience, training background, etc.):
- 2. Describe drill rig and equipment inspection criteria or procedures (frequency of inspections, visual vs. written inspections, items that are inspected):
- 3. Describe methods of identifying underground utilities (contacting utility companies, third party instrumented locates, drawing review, personnel interviews, detection equipment, etc.):
- 4. Describe methods of avoiding contact with overhead power lines (de-energizing and grounding, insulating, safe clearance distances):
- 5. Describe methods to identify hazardous atmospheres and controls used to eliminate (detection equipment and controls):
- 6. Describe leveling and stabilizing methods for drill rig (drilling pad preparation, jacks, cribbing, guy wires):
- 7. Verify that rig equipment is in good operational condition (including "kill" switch, cathead, ropes, pressurized hoses and lines, operator controls, machine guards, and drilling tools):
- 8. Describe procedures for operating in inclement weather, including lightning, high winds, severe rain storms:
- 9. Describe other safe work practices for equipment operation (drill rig, equipment, tools, rig transportation, rig travel):
- 10. Describe on-the-job maintenance procedures, including lockout/tagout:
- 11. Describe safe work practices for other activities to be performed during this project (use of ladders, fall protection, use of electrical power tools, use of personal protective equipment, etc.):
- 12. Describe methods for disposal of non-hazardous drill cuttings and purge water (including accumulation, transport, and disposal):
- 13. If hazardous waste project, provide documentation of hazardous waste worker training and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training) and describe methods of hazardous waste management (including accumulation, transport, and disposal):
- 14. Submit a copy of drilling license/certification and drill rig permit:
- 15. Describe methods and responsibilities for submittal of notifications and logs:

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- 16. Complete the Waste Subcontractor Qualification Form for each proposed transport and disposal facility:
- 17. Describe procedures for drilling site clean-up upon job completion.

If drilling in areas with known or potential Munitions and Explosives of Concern (MEC) hazards:

18. Provide documentation of UXO qualifications, hazardous waste worker training, medical surveillance records, and drug testing for all project personnel (Technical EOD/UXO training certificate, 40-hour or 24-hour training, 8-hour refresher training):

19. Describe procedures for MEC avoidance, identification and marking the boundaries of a clear approach path and work site for the sampling crews, vehicles, and equipment to enter the site:

20. Describe the procedures for drilling and monitoring, and the process for encountered MEC.

CH2MHILL. Attachment 2: HSE Self-Assessment Checklist - Drilling

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to drilling hazards, 2) CH2M HILL staff are providing support function related to drilling activities, and/or 3) CH2M HILL oversight of a drilling subcontractor is required.

Safety Coordinator may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name:		_ Project No.:
Location:	PN	<u>۸:</u>
Auditor:	Title:	Date:
 This specific checklist has been completed to: Evaluate CH2M HILL employee exposures to dril Evaluate CH2M HILL support functions related to Evaluate a CH2M HILL subcontractor's complian Subcontractors Name:	lling hazards (complete Sec o drilling activities (comple nce with drilling safety requ	tion 1). te Section 2) irements (complete entire checklist).

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in SOP HSE-204.

	SECTION 1 - SAFE WORK PRACTICES - 5.1					
1. 2. 3. 4. 5. 6. 7.	Personnel cleared during rig start-up, positioning and setup Personnel clear of rotating parts Personnel not positioned under hoisted loads Loose clothing and jewelry removed Smoking is prohibited around drilling operation Personnel wearing appropriate personal protective equipment (PPE), per HSP or FSI Personnel instructed not to approach equipment that has become electrically energized			<u>N/A</u> N/O		
	SECTION 2 - SUPPORT FUNCTIONS - 5.2					
AQ 8.	AQUIFER DESIGNATIONS (5.2.1) 8. Aquifer designations determined and BGEM consulted when required.					
LO 9. 10.	CATION OF UTILITIES (5.2.2) Location of underground and overhead utilities and structures identified Utility company contacted to de-energize/ground power lines due to clearance					

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HSE Self-Assessment Checklist - Drilling		Pa	ge 2 o	of 4				
SUPPORRT FUNCTIONS – 5.2 (Continued)								
 WASTE MANAGEMENT (5.2.3) 11. Drill cuttings and purge water managed and disposed properly 12. Wastes generated evaluated for proper disposal 13. Appropriate decontamination procedures being followed, per project's written safety plan 	<u>Yes</u>			<u>N/O</u>				
 DRILLING AT ORDNANCE EXPLOSIVES OR UNEXPLODED ORDNANCE SITES (5.2 14. MEC plan prepared and approved 15. MEC avoidance provided, routes and boundaries cleared and marked 16. Initial pilot hole established by UXO technician with hand auger 17. Personnel remain inside cleared areas 	.4)							
SECTION 3 - DRILLING SAFETY REQUIREMENTS -5.3								
 GENERAL (5.3.1) 18. Only authorized personnel operating drill rigs 19. Daily safety briefing/meeting conducted with crew 20. Daily inspection of drill rig and equipment conducted before use 21. Good housekeeping maintained on and around rig 								
 SAFETY EQUIPMENT (5.3.2) 22. Safety-toed boots, hardhats, safety glasses w/side shields, gloves and hearing protection worn 23. Drill rig equipped with fire extinguisher 24. Air monitoring instruments provided when required 25. Reflective/high visibility vests worn when required 26. PPE for protection from chemical hazards worn if required 								
 BURIED UTILITY AND OVERHEAD CLEARANCE (5.3.3) 27. Location of underground utilities and structures identified, including third party locate 28. 360° visual observation conducted 29. Hand digging, air knifing conducted to expose utilities before drilling 30. Safe clearance distance maintained from overhead power lines 31. Power lines de-energized and grounded when safe distances cannot be maintained 								
 DRILL RIG PLACEMENT (5.3.4) 32. Drilling pad established, when necessary 33. Drill rig leveled and stabilized 34. Additional precautions taken when drilling in restricted areas 35. In Karst topography use remote sensing or geologist review for sinkholes 								
DRILL RIG TRAVEL (5.3.5)								
 36. Rig shut down and mast lowered and secured prior to rig movement 37. Tools and equipment secured prior to rig movement 38. Only personnel seated in cab wearing a seat belt are riding on rig during movement 39. Backup alarm or spotter used when backing rig 40. Spotter used when backing rig in tight or restricted areas or when low clearances exist 41. Safe clearance distance maintained while traveling under overhead power lines 								
EMERGENCY – CONTACT WITH OVERHEAD OR UNDERGROUND ELECTRICAL L	INES	(5.3.6)						
42. Personnel understand emergency procedures in the event of contact with overhead or underground electrical lines								
DRILL RIG OPERATION (5.3.7)	_	_	_	_				
43. Drill rig operated in accordance with operators' manual44. Personnel clear while mast is being raised45. Kill switch clearly identified, operational, and in reach of the operator control station								

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SECTION 3 - DRILLING SAFETY REQUIREMENTS - 5.3 (Continued) 46. All machine guards are in place
46. All machine guards are in place Rig ropes never wrapped around any part of the body Rig ropes never wrapped around any part of the body Rig goes never wrapped around any part of the body Rig goes never wrapped during inclement weather Drilling operation stopped during inclement weather Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig gear boxes placed in neutral when operator not at controls Rig group openings/holes filled or barricaded Rig group openings/holes filled or barricaded Rig gear boxes and tools properly stored Rig gear boxes and tools properly stored Rig group openings/holes filled or barricaded Rig properly maintained per drilling company's maintenance program Rig properly maintained per drilling company's maintenance program
47. Rig ropes never wrapped around any part of the body
48. Pressurized lines and hoses secured to prevent whipping hazards
49. Drilling operation stopped during inclement weather
50. Air monitoring conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducted per written safety plan for hazardous atmospheres Image: Single conducten safety plan for hazardous atmospheres Ima
51. Rig gear boxes placed in neutral when operator not at controls
52. Operator shuts rig engine down prior to leaving the drill rig vicinity
DRILL RIG SITE CLOSURE (5.3.8) 53. Ground openings/holes filled or barricaded 54. Equipment and tools properly stored 55. All vehicles locked and keys removed DRILL RIG MAINTENANCE (5.3.9) 56. Rig properly maintained per drilling company's maintenance program and means as site/available for pariow
53. Ground openings/holes filled or barricaded
54. Equipment and tools properly stored
55. All vehicles locked and keys removed
DRILL RIG MAINTENANCE (5.3.9) 56. Rig properly maintained per drilling company's maintenance program
56. Rig properly maintained per drilling company's maintenance program
and records on site/evailable for review
57. Defective components repaired immediately
58. Lockout/tagout procedures used prior to maintenance
59. Cathead in clean, sound condition
60. Drill rig ropes in clean, sound condition
61. Fall protection used for fall exposures of 6 feet (U.S.) 1.5 m or greater
62. Rig in neutral and augers stopped rotating before cleaning
63. Good housekeeping maintained on and around rig
FORMS/PERMITS AND CHECKLISTS (7.0)
64. Driller license/certification obtained
65. Well development/abandonment notifications and logs submitted and in project files
66. Groundwater withdrawal permit obtained where required
67. Dig permit obtained where required



HSE Self-Assessment Checklist - Drilling

SECTION 3

Complete this section for all items checked "No" in previous sections. Deficient items must be corrected in a timely manner. Item Date # **Corrective Action Planned/Taken** Corrected

Auditor: _____ Project Manager: _____

HSE-204 VERSION 2 - A2

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HS&E Self-Assessment Checklist – Electrical Safety

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used at locations when: (1) CH2M HILL employees are required to use electrical appliances, are exposed to electrical hazards, or are working on or near exposed energized electrical equipment; and/or (2) CH2M HILL provides oversight of an electrical subcontractor.

The Safety Coordinator (SC) may consult with electrical subcontractors when completing this checklist, but shall not direct the means and methods of electrical operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and CH2M HILL must carefully rely on their expertise. Items or conditions considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Pro	oject Name:	Project No.:				_
Lo	cation:	Project Manager:				
Auditor:						
•	Check "Yes" if an assessment item is con	nplete/correct.				
•	Check "No" if an item is incomplete/defie subcontractor. Section 3 must be complet	cient. Deficiencies shall be brought to the immediate atte ed for all items checked "No."	ntion of	the		
•	Check "N/A" if an item is not applicable.					
•	Check "N/O" if an item is applicable but	was not observed during the assessment.				
Nu	mbers in parentheses indicate where a desc	ription of this assessment item can be found in Standard	of Pract	tice H	ISE-20	16.
Ge	neral Requirements (5.1)	v training	Yes	No	N/A	<u>N/O</u>
1. 2. 3. 4. 5. 6. 7. 8. Ele	Attempts are made to locate all energized Installation/repair areas sufficiently guard Only qualified employees installing or we Electrical circuits that may be contacted a Lockout/Tagout procedures when require Only qualified electrical workers defeatin Where the location of underground power ectrical Power Tools and Extension Cord	y training. electrical circuits before work begins. led with barriers and signs to prevent unauthorized entry. orking with electrical equipment. ure de-energizing and grounded or guarded. d verified using the checklist provided in HSE-307. g electrical safety interlocks. r lines is unknown, insulated gloves are used. ls (5.3)				
 9. 10. 11. 12. 13. 14. 15. 16. 	Electric power tools and extension cords Extension cords supplying power tools pr Electric power tools operated and maintai Electric power tools effectively grounded Extension cords grounded and designed f Extension cords not substituted for fixed Extension cords covered, elevated, or pro Extension cords passing through doorway Extension cords passing through doorway	inspected prior to use. Damaged equipment not used. rovided with Ground Fault Circuit Interrupters (GFCI). ined according to manufacturer's instructions. or double-insulated. or heavy duty or industrial grade. wiring. tected when passing through work areas. // s or other pinch points protected from damage. wurb walls_coilings_or floors				

18. Extension cords not fastened with staples, hung from nails, or suspended with wire.

19. Working space, walkways, and similar areas are kept clear of cords to prevent tripping hazards.

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HS&E Self-Assessment Checklist - Electrical

SECTION 1 – SAFE WORK PRACTICES (Continued)				
Portable Lighting (5.4)	Yes	No	N/A	<u>N/O</u>
20. Portable lights not suspended by their electric cords unless designed for suspension	H	H	H	H
22. Portable lights protected from contact or breakage	H	H	H	H
23 Portable lights used in wet locations operated at 12 volts or less or used with GECI	H	H	H	H
25. Torable fights used in wet focutions operated at 12 toras of less of used what of eff				
Overhead Power Lines (5.5)				
24. Lines de-energized and grounded, insulated, or safe clearance distance maintained.				
25. Personnel stay clear of grounding point of equipment intentionally grounded.				
26. Personnel do not touch or approach equipment that has become energized.				
SECTION 2 – ELECTRICAL SAFETY REQUIREMENTS				
General Installation Requirements (5.7)				
35. Competent person overseeing electrical activities, including inspections.	H	H	H	H
36. Subcontractor personnel using appropriate safety and protective equipment.	H	H	H	H
 S7. Electrical equipment mee from recognized nazards. Regimment approved for intended use and installed according to approvels. 		H	H	H
30. Manufacturar's name, trademark, or other descriptive marking placed on equipment	H	H	H	H
40 Energized parts > 50 yelts guarded against accidental contact	H	H	H	H
40. Electrical againment > 600 volts placed in a yault room, closet, or protected area	H	H	H	
41. Electrical equipment > 000 vors placed in a vault, room, closet, or protected area.	H	H	H	H
42. Sufficient access and working clearances provided and maintained for an electric equipment.	H	H	H	H
44 Circuit breakers sufficient for system current load	H	H	H	H
45 Over-current protection devices readily accessible and legibly marked to indicate purpose	H	H	H	
46. Equipment firmly secured to surface on which it is mounted.	H	Н	Н	H
47. Electrical equipment ventilated for cooling as required.	H	H	H	H
48. Electrical equipment protected from damage by environmental conditions.		П	П	
49. Equipment in hazardous locations maintained in a dust-tight, ignition-proof condition.		П	П	
50. Equipment producing arcs, sparks, flames, enclosed or separated from combustible material.				
51. Conductors spliced or joined properly and free ends covered with insulation.				
52. Equipment grounding provided on all equipment requiring such grounding.				
Cround foult Protection (5.6)				
Ground-taun Protection (5.0) 53 GECIs used or an assured equipment grounding conductor (AEGC) program implemented				
54. When GECIs used installed on all 120 volt 15 and 20 ampere temporary recentedle outlets	H	H	H	H
55. When AFGC program used, covers all extension cords and temporary receptacles	H	H	H	H
56 AEGC program also covers all equipment connected by cord and plug	H	H	H	H
57. Under AEGC program, equipment visually inspected for external defects before each day's use	H	H	H	H
58. Under AEGC program, continuity and grounding testing performed at least every 3 months.	H	Н	Н	H I
59. Records maintained for all AEGC program testing.				

CH2MHILL[®] HS&E Self-Assessment Checklist – Electrical

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	SECTION 3					
Compl	Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.					
Item		Date				
#	Corrective Action Planned/Taken	Corrected				
Audito	pr: Project Manager:					

Attachment 1: Subcontractor Safety Procedure Criteria-Earthmoving Equipment

The following criteria are not intended to be all inclusive, but are provided as a tool to facilitate development and review of subcontractor safety procedures. Subcontractors are expected to address the following items in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Earthmoving Equipment Safety Procedures:

- 1. Provide name and qualifications of the "competent person" responsible for earthmoving equipment (years and type of experience, training background, etc.):
- 2. Provide qualifications of equipment operators (years and type of experience, training background, etc.):
- 3. Describe earthmoving equipment and associated component inspection criteria or procedures (frequency of inspections, visual vs. written inspections, items that are inspected):
- 4. Describe methods of identifying underground utilities (contacting utility companies, detection equipment):
- 5. Describe methods of avoiding contact with overhead power lines: (de-energizing and grounding, insulating, safe clearance distances)
- 6. Describe methods of avoiding "on-foot" traffic and other safe operating procedures (backup alarms, horns, spotters, high-visibility vests, safe operating speed and slope, etc.):
- 7. Describe methods to identify hazardous atmospheres and controls (detection equipment and controls):
- 8. Verify that earthmoving equipment is in good operating condition (including seat belts, rollover protective systems, braking system, lights, cab glass, pressurized hoses and lines, operator controls, machine guards, and accessories):
- 9. Describe on-the-job maintenance procedures (including lockout/tagout, blocking, cribbing, etc.):
- 10. Describe safe work practices for other activities to be performed during this project (use of ladders, fall protection, use of electrical power tools, use of personal protective equipment, etc.):

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Attachment 2: Earthmoving Equipment Inspection Form

EARTHMOVING EQUIPMENT INSPECTION FORM

This form shall be used to document CH2M HILL earthmoving equipment inspections. Earthmoving equipment shall be inspected each day and shift prior to use. All components shall be inspected for damage and proper operation. Any component failing the inspection shall be corrected prior to earthmoving equipment use. Check each box after passing inspection and initial bottom of form each day.

Equipment Name:	cation #:	Week of:						
INSPECTION ITEM		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Visual Checks								
Operating manual – present								
Controls - labeled as to their function, visible and legible, safe	ty latches/guards present							
Tires/tracks - proper inflation/tension, not excessively worn	or damaged							
Fluid levels/leaks - engine, transmission, hydraulic, radiator,	swing motor and PTO oils.							
Lubrication - to the manufacturer's specifications								
Air filter gauge - gauge is not in the red zone.								
Hydraulics - no fluid leaks, connections tight, hoses, cylinders	s free of damage.							
Hoses/belts - held securely, not loose or rubbing, no excessive	e wear or crimping							
Fuel system - tank free of damage, all valves/hoses secure, no	leaks							
Body & ground-engaging tools – no damage, cracks, bends, or	excessive wear.							
Cylinders/articulation joints- no worn pins, loose connections	s or other damage.							
Roll-over protective structures (ROPS) - no damage, no cracks	or bends							
Seat belt/bar - required unless operator stands or no ROPS								
Handrails, steps, platforms - clean, free from grease, oil, clear	of obstructions.							
Cab glass - safety glass, clean, no cracks or visible distortion								
Mirrors - properly adjusted, no cracks or visible distortion								
Windshield wipers, fluid, and defroster - functioning								
Machine guards - present and in good condition								
Fire extinguisher – present and charged								
Operational Checks – check items through norma	al maneuvers							
Horn & back-up alarm – operating and distinguishable from s	urrounding noise							
Lights, directional signals, and brake lights - functioning								
Gauges/indicators - visible and working properly								
Operating controls - lift and tilt functioning properly								
Outriggers, if present - functioning properly								
Accelerator - even acceleration, does not stick								
Brakes (service & parking) - brings to complete stop, holds in	fixed position							
Steering – responsive, minimal looseness								
Exhaust system - guarded if potential for contact, no signs of	sparks/leaks							
Inspector's Initials								

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Attachment 3: Earthmoving Equipment Operator Evaluation Form

EARTHMOVING EQUIPMENT OPERATOR EVALUATION FORM

Page 1 of 2

CH2M HILL employees who are required to operate earthmoving equipment shall be evaluated and approved as qualified earthmoving equipment operators by an authorized CH2M HILL Earthmoving Equipment Operator Evaluation Designated Persons (DP).

This form shall be used by the DP to assess, approve, and document the qualifications of CH2M HILL employees who are required to operate earthmoving equipment.

Employee (Operator) Name:	CH2M HILL employee #:			
CH2M HILL Company:	Business Group:	Region:		
Type of equipment to be				

operated:

1. Background Review

Resume and other documentation (training certificates) shall be reviewed and verified with previous employers. The individual shall also possess a valid driver's license. This review should take place prior to hiring.

Background Review found to be adequate. Date: __/___ DP initials: ____

2. Classroom Evaluation

- a. Employee shall read and understand the manufacturer's Equipment Operation Manual for the specific piece of equipment to be operated.
- b. Employee shall read and understand the CH2M HILL *Earthmoving Equipment* (HSE-306) and *Excavations* (HSE-307) Standards of Practice.
- c. DP shall discuss safe operating practices with the employee.
- d. Employee shall pass CH2M HILL's written earthmoving equipment operator exam. (See Attachment 2 for exam guidelines)
- Classroom Evaluation successfully completed. Date: __/__/ DP initials: ____

3. Field Evaluation

a. Equipment Awareness, Inspection and Maintenance

The DP shall observe the employee perform a daily inspection using the Earthmoving Equipment Inspection Form. The employee shall demonstrate the ability to recognize deficient conditions that could affect the safe operation of the equipment. In addition, the operator shall demonstrate awareness of the following:

- Location of vital fluid reservoirs
- Location of all lubrication points
- Proper fueling procedures
- Location and function of safety disabling devices (if equipped)

Location and function of safety devices (fire extinguisher, back-up alarm, seat belt/bar, guards)

- Location of manufacturer warning labels, weight of equipment, and lift capacities labels
- Location and function of all gauges, indicators and controls (horn, lights, mirrors, etc.)
 - Acceptable conditions for passing items during daily inspections
- Periodic maintenance requirements

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EARTHMOVING EQUIPMENT OPERATOR EVALUATION FORM

b. Equipment Operation

The DP shall observe the employee operating the equipment through normal maneuvers. The employee shall demonstrate the ability to operate the equipment safely and in accordance with the manufacturer's guidelines.

	Demonstrates ability to safely start equipment in preparation for use (proper start-up sequence
followe	d)
	Understands function and proper appearance of all gauges and indicators
	Understands location and use of all equipment controls
	Checks front, side, and rear of equipment for pedestrians, traffic and obstructions
	Demonstrates smooth and safe equipment travel
	Demonstrates smooth and safe control operations
	Demonstrates safe loading and binding of equipment for travel
	Demonstrates normal shut-down procedures
	Demonstrates emergency shut-down procedures
	Demonstrates safe parking and storage of equipment
	Field Evaluation successfully completed. Date:/ DP initials:

Operator Acknowledgement

I have reviewed and understand all of the information listed above. I also understand that as an operator of this equipment, I am responsible for daily inspections and maintenance as well as the safe and efficient operation of the equipment listed above.

Signature

Date

Date

Date

Qualification approval

The employee has completed the earthmoving equipment operator evaluation process and is qualified to operate the type of earthmoving equipment identified above.

Signature

DP Name

HS&E Name

A copy of this evaluation form shall be maintained in the project file and the original sent to the HS&E department for retention.

Signature

Attachment 4:

Earthmoving Equipment Operator Exam Guideline

This guideline is provided to assist the CH2M HILL Earthmoving Equipment Operator Evaluation Designated Person (DP) in administering and processing the earthmoving equipment operator exam.

- 1. The earthmoving equipment operator exam and answer key is maintained on the HS&E limited access web page and may be obtained from the HS&E department.
- 2. The DP shall administer the exam to each potential CH2M HILL earthmoving equipment operator as part of the evaluation process outlined in the CH2M HILL Earthmoving Equipment Operator Evaluation Form (Section 2, d).
- 3. CH2M HILL earthmoving equipment operators must be evaluated for each specific piece of equipment to be operated; however, this exam is only required to be taken and passed one time by each operator. Once an operator has passed this exam, no further testing is required.
- 4. The DP shall review each question answered incorrectly to ensure the operator has a clear understanding of the specific requirement.
- 5. A specific passing grade has not been established for this exam. The DP shall use their judgment as to whether an individual has an adequate knowledge of the safety issues pertaining to the operation of earthmoving equipment. This exam is only a tool to evaluate the individuals level of understanding.
- 6. Upon completion and review of the exam, the DP shall sign, date, and indicate whether the individual passed or failed the exam. The exam shall then be sent to the HS&E department for retention.

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Attachment 5: HSE Self-Assessment Checklist-Earthmoving Equipment

HS&E Self-Assessment Checklist - EARTHMOVING EQUIPMENT

Page 1 of 2

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to the hazards of earthmoving equipment operations, 2) CH2M HILL employees are operating earthmoving equipment, and/or 3) CH2M HILL provides oversight of a subcontractor operating earthmoving equipment.

The CH2M HILL Safety Coordinator may consult with subcontractors operating earthmoving equipment when completing this checklist, but shall not direct the means and methods of equipment operations nor direct the details of corrective actions. Earthmoving equipment subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name:	Project No.:			
Location:	PM:			
Auditor:	Title:	Date:		
 This specific checklist has been completed to: Evaluate CH2M HILL employee exposures to earthmoving equipment hazards (complete Section 1). Evaluate CH2M HILL employees operating earthmoving equipment (complete entire checklist). Evaluate CH2M HILL subcontractor's compliance with earthmoving equipment safety requirements (complete entire checklist). Subcontractors Name:				

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the earthmoving equipment subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HSE-306.

SA	SAFE WORK PRACTICES (5.1)SECTION 1		No	N/A N/O
1. 2. 3. 4. 5. 6. 7. 8. 9. 10.	Personnel maintaining safe distance from operating equipment Positioning personnel in close proximity to operating equipment is avoided Personnel wearing high-visibility and/or reflective vests when close to operating equipment Personnel approach operating equipment safely Personnel riding only in seats of equipment cab and using seat belts Personnel not positioned under elevated portions of equipment Personnel not positioned under hoisted loads Personnel not hoisted by equipment Personnel do not to approach equipment that has become electrically energized Personnel wearing appropriate PPE, per HSP/FSI			

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HS&E Self-Assessment Checklist - EARTHMOVING EQUIPMENT

Page 2 of 2

EQ	UIPMENT SAFETY REQUIREMENTS <u>SECTION 2</u>	Yes	No	N/A I	<u>N/O</u>			
PRIOR TO OPERATING EQUIPMENT (5.2.1)								
 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 	Only qualified and authorized personnel operating equipment Daily safety briefing/meeting conducted with equipment operators Daily inspection of equipment conducted and documented Modifications and attachments used approved by equipment manufacturer Backup alarm or spotter used when backing equipment Operational horn provided on bi-directional equipment Seat belts are provided and used Rollover protective structures (ROPS) provided Braking system capable of stopping full payload Headlights and taillights operable when additional light required Brake lights in operable condition Cab glass provides no visible distortion to the operator All machine guards are in place Hauling equipment (dump trucks) provided with cab shield or canopy Dump truck beds provided with positive means of support during maintenance or inspection Dump truck operating levers provided with latch to prevent accidental dumping Air monitoring conducted per HSP/FSI for hazardous atmospheres							
EQ	UIPMENT PLACEMENT (5.2.2)							
 28. 29. 30. 31. 32. 33. 34. 	Equipment position on firm/level surface, outriggers used Location of underground utilities identified Safe clearance distance maintained while working under overhead power lines Safe distance is maintained while traveling under power lines Warning system used to remind operator of excavation edge Unattended equipment visibly marked at night Tools lowered/parking brake set when not in use, wheels chocked when parked on incline							
EQ	UIPMENT OPERATION (5.2.3)							
 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 	Equipment operated on safe roadways and grades Equipment operated at safe speed Operators maintain unobstructed view of travel path Equipment not operated during inclement weather, lightning storms Equipment started and moved safely Operators keep body parts inside cab during operation Vehicle occupants in safe position while loading/unloading Signal person visible to operator when required Equipment used for hoisting done according to equipment manufacturer specifications Lifting and hauling capacities are not exceeded							
EQ 45. 46. 47. 48. 49.	UIPMENT MAINTENANCE (5.2.4) Defective components repaired immediately Suspended equipment or attachments supported prior to work under or between Lockout/tagout procedures used prior to maintenance Tires on split rims removed using safety tire rack or cage Good housekeeping maintained on and around equipment							

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HSE Self-Assessment Checklist – EARTHMOVING EQUIPMENT

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SECTION 3							
Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.							
Item #	Corrective Action Planned/Taken	Date Corrected					

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Auditor: _____ Project Manager: _____

CH2MHILL_®

FORKLIFT INSPECTION FORM

This form shall be used to document CH2M HILL forklift inspections. Forklifts shall be inspected each day prior to use. All components shall be inspected for damage and proper operation. Any component failing the inspection shall be corrected prior to forklift use. Check each box after passing inspection and initial bottom of form each day.

Forklift Brand: Identification #:		Week of:							
INSPECTION ITEM		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
Visual Checks									
ID Plate - visible and legible, lifting capacity adequat	e to perform the designated task								
Tires - tread in good condition, not excessively worn	, no punctures								
Forks/Backrest/Mast - no damage, no cracks or ben	ds, no loose or missing bolts/pins								
Carriage/Chain - greased, links intact, no excessive s	slack or unusual wear, free to travel								
Overhead Guard - structural soundness, no cracks, n	othing on top or impeding vision								
Hydraulics - no fluid leaks, piston free of debris									
Fluid levels – levels adequate, no leaks									
Hoses/belts - held securely, not loose or rubbing, no	excessive wear or crimping								
Electric units - battery charged and in good condition	n, connections tight - no corrosion								
Gasoline/diesel units - fuel tank free of damage, all	valves/hoses secure								
LPG units - propane tank free of damage and secure	d to forklift in designated position								
Seat belt or lap bar									
Fire extinguisher - present and charged									
Mirrors									
Guards - present and in good condition									
Operational Checks - check items throug	h normal maneuvers								
Horn									
Operating and warning lights									
Directional signals									
Back-up alarm									
Gauges/indicators - visible and working properly									
Hydraulic controls - mast lift and tilt									
Accelerator - even acceleration, does not stick									
Brakes - brings to complete stop, parking brake holds	s in fixed position								
Dead man brake - seat actuated									
Steering - responsive, minimal looseness									
Clutch - verify that transmission disengaged									
Exhaust system - in good condition, no signs of spar	ks or leaks								
Inspector's Initials									

Attachment 3: HSE Self Assessment Checklist-Forklifts
H&S Self-Assessment Checklist - FORKLIFTS

Page 1 of 2

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with forklift operations, 2) CH2M HILL employees are operating forklifts, and/or 3) CH2M HILL provides oversight of a subcontractor operating forklifts.

SC may consult with subcontractors using forklifts when completing this checklist, but shall not direct the means and methods of forklift operations nor direct the details of corrective actions. Subcontractors using forklifts shall determine how to correct deficiencies, and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Project Name: Project No.:					
Location:		PM:			
Auditor:	Title:		_ Date:		
This specific checklist has been completed to:					
 Evaluate CH2M HILL employee exposures to forklift hazards (Complete Section 1). Evaluate CH2M HILL employees operating forklifts (Complete entire checklist). Evaluate a CH2M HILL subcontractor's compliance with forklift safety requirements (Complete entire checklist). Subcontractor's Name: 					

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-309.

SA	FE WORK PRACTICES (5.1)SECTION 1	Yes	No	N/A	<u>N/O</u>
1. 2. 3. 4. 5. 6. 7. 8. 9.	Personnel maintaining safe distance from operating forklifts. Positioning personnel in proximity to operating forklifts is avoided. Personnel wearing high-visibility vests when close to operating forklifts. Personnel approach operating forklifts safely. Personnel only riding in seats equipped with seat belts. Personnel not lifted or lowered by forklift unless approved for such use. Personnel not positioned under elevated loads or forks. Personnel do not place body between mast uprights or outside running lines during operation. Personnel do not touch or approach forklift that has become electrically energized.				

H&S Self-Assessment Checklist - FORKLIFTS			Page 2 of	
FORKLIFT SAFETY REQUIREMENTS SECTION 2	Yes	No	N/A	N/O
 PRIOR TO OPERATING FORKLIFT (5.2.1) 10. Only certified personnel operating forklifts. 11. Daily safety briefing/meeting conducted with forklift operators. 12. Daily inspection of forklift conducted and documented. 13. Rated capacity of forklift visible to operator. 14. Modifications and attachments used approved by forklift manufacturer. 15. High-lift forklifts have load backrest and overhead guard. 16. Seat belts are provided and used. 17. Backup alarm or spotter used when backing forklift. 18. Operational horn provided and used as necessary. 19. Braking system capable of stopping capacity load. 20. Forklifts equipped with lights for low-light operations. 21. Carbon monoxide concentrations below PEL (50 ppm). 22. At least one fire extinguisher available at the forklift operating area. 				
 23. Atmosphere/locations classified as hazardous or non-hazardous. 24. Only properly designated forklifts used in hazardous locations. 				
 FORKLIFT LOADING/UNLOADING (5.2.3) 25. Operator handles only loads within rated capacity, adjusts for long or tall loads. 26. Loads are stabilized before forklift travel. 27. Operator using proper tilt to stabilize load, uses caution when tilting elevated loads. 28. When two forklifts lift a load in unison, operators stay in close communication. 29. Trucks, trailers, railroad cars secured from movement before entering with forklift. 30. Dockplates/bridgeplates secured before use; capacity not exceeded. 31. Truck, trailer, railroad car flooring checked for weakness before forklift boarding. 32. Personnel platforms secured to forklift and shut off means provided on platform. 				
 FORKLIFT TRAVEL (5.2.4) 33. Forklift operated on safe roadways and grades. 34. Grades ascended/descended properly. 35. Forklift operated at safe speed, kept under control at all times 36. Operators slow down and use horn at areas with obstructed vision. 37. Forklifts operating in reverse when load obstructs vision. 38. Operator keeping clear view of path of travel. 39. Forklifts do not pass other stopped vehicles at areas with obstructed vision. 40. Operators maintain safe distance from edge of ramps and platforms. 41. Overhead clearance maintained from installations. 42. Forklifts not parked within 8 feet of center of railroad tracks. Tracks crossed diagonally. 43. Forklift parked correctly when operator is dismounted. 				
 FORKLIFT MAINTENANCE (5.2.5) 44. Forklifts with unsafe conditions removed from service and tagged as such to prevent use. 45. Forklifts repaired in designated, non-hazardous locations by authorized personnel. 46. Battery disconnected when repairing electrical systems. 47. Additions or omissions of parts not performed without manufacturer's approval. 48. Good housekeeping maintained on and around forklift. 49. Water mufflers checked daily, kept at 75% full. 50. Forklifts removed from service if sparks, flames, or elevated operating temperatures occur. 51. Suspended forklifts or components are supported prior to work under or between. 52. Fueling/battery charging conducted in designated, well-ventilated area. 53. Fueling/battery charging areas properly equipped for task. 54. No smoking in fueling/battery charging areas. 55. Spillage of fuel properly cleaned up before starting forklift. 				

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HSE Self-Assessment Checklist – FORKLIFTS

	SECTION 3			
Compl	lete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely	manner.		
Item #	Corrective Action Planned/Taken	Date Corrected		
-				
1				

 Auditor:
 Project Manager:

Attachment 1: Subcontractor Safety Procedure Criteria-Hand and Power Tools

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate development and review of subcontractor hand and power tool procedures. Subcontractors are expected to address the following items in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Hand and Power Tool Safety Procedures:

- 1. Describe the method of training and qualifying personnel in the use of powder-actuated tools if such tools are to be used on the project.
- 2. Provide safe work practice guidelines on use and limitations for the types of hand and power tools to be used.
- 3. Provide a list of the types, work areas, and activities where special hand and power tools will be used.
- 4. Describe plans for the inspection of hand and power tools prior to introducing such tools to the work environment (i.e., tools brought on site by equipment rental vendors, home office storage facilities/yards, new purchases, employee supplied, etc.).
- 5. Provide a description of hand and power tool inspection criteria or procedures (frequency of inspections and items that are inspected).

The following safety procedures criteria, specifically applies to chain saw operations:

- 6. Provide qualifications of chainsaw operators (training, years and type of experience, etc.)
- 7. Describe personal protective equipment to be used by chain saw operators.
- 8. Describe safety equipment to be provided to ensure safe chain saw operation.
- 9. Describe inspection criteria or procedures (frequency of inspections per work shift, as needed throughout day; visual versus written inspections; items that are inspected).
- 10. Describe safe work practices (safe operation, refueling, maintenance, transport).
- 11. Describe methods of avoiding contact with overhead power-lines (contacting utilities, de-energizing and grounding, insulating, safe clearance distances).
- 12. Describe methods of protecting the public and others onsite (barricading, danger zone established, traffic control, etc.).
- 13. Describe safe work practices or procedures for the specific work to be performed (tree feeling, limbing standing trees, limbing fallen trees, bucking trees, etc.).

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Attachment 2 - HSE Self-Assessment Checklist—HAND AND POWER TOOLS Page 1 of 4

This checklist shall be used by CH2M HILL personnel only and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees are exposed to hand and power tool hazards and/or (2) CH2M HILL provides oversight of subcontractor personnel who are exposed to hand and power tool hazards.

SC may consult with subcontractors when completing this checklist, but shall not direct the means and methods of hand and power tool use nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered being imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-210.

<u>SECTION 1</u>				
	Yes	No	N/A N/O	
SAFE WORK PRACTICES (5.1)				
 All tools operated according to manufacturer's instructions and design limitations. All hand and power tools maintained in a safe condition and inspected and tested before use. Defective tools are tagged and removed from service until repaired. PPE is selected and used according to tool-specific hazards anticipated. Power tools are not carried or lowered by their cord or hose. Tools are disconnected from energy sources when not in use, servicing, cleaning, etc. Safety guards remain installed or are promptly replaced after repair. Tools are stored properly. Cordless tools and recharging units both conform to electrical standards and specifications. Tools used in explosive environments are rated for such use. Knives/open blade tools only used when approved with written precautions, PPE, and training 12. Consider controls to avoid muscular skeletal, repetitive motion, and cumulative trauma stressors 				

CH2MHILL HSE Self-Assessment Checklist—HAND AND POWER TOOLS

SECTION 2	Yes	No	N/A N/C	<u>)</u>
 GENERAL (5.2.2) 13. PPE is selected and used according to tool-specific hazards anticipated. 14. Tools are tested daily to assure safety devices are operating properly. 15. Damaged tools are removed from service until repaired. 16. Power operated tools designed to accommodate guards have guards installed. 17. Rotating or moving parts on tools are properly guarded. 18. Machines designed for fixed locations are secured or anchored. 19. Floor and bench-mounted grinders are provided with properly positioned work rests. 20. Guards are provided at point of operation, nip points, rotating parts, etc. 21. Fluid used in hydraulic-powered tools is approved fire-resistant fluid. 				
 ELECTRIC-POWERED TOOLS (5.2.3) 22. Electric tools are approved double insulated or grounded and used according to SOP HSE-206. 23. Electric cords are not used for hoisting or lowering tools. 24. Electric tools are used in damp/ wet locations are approved for such locations or GFCI installed. 25. Hand-held tools are equipped with appropriate on/off controls appropriate for the tool. 26. Portable, power-driven circular saws are equipped with proper guards. 				
 ABRASIVE WHEEL TOOLS (5.2.4) 27. All employees using abrasive wheel tools are wearing eye protection. 28. All grinding machines are supplied with sufficient power to maintain spindle speed. 29. Abrasive wheels are closely inspected and ring-tested before use. 30. Grinding wheels are properly installed. 31. Cup-type wheels for external grinding are protected by the proper guard or flanges. 32. Portable abrasive wheels used for internal grinding are protected by safety flanges. 33. Safety flanges are used only with wheels designed to fit the flanges. 34. Safety guards on abrasive wheel tools are mounted properly and of sufficient strength. 				
 35. Tools are secured to hoses or whip by positive means to prevent disconnection. 36. Safety clips or retainers are installed to prevent attachments being expelled. 37. Safety devices are installed on automatic fastener feed tools as required. 38. Compressed air is not used for cleaning unless reduced to < 30 psi, with PPE, and guarded. 39. Manufacturer's safe operating pressure for hoses, pipes, valves, etc. are not exceeded. 40. Hoses are not used for hoisting or lowering tools. 41. All hoses >1/2-inch diameter have safety device at source to reduce pressure upon hose failure. 42. Airless spray guns have required safety devices installed. 43. Blast cleaning nozzles are equipped with operating valves, which are held open manually. 44. Supports are provided for mounting nozzles when not in use. 45. Air receiver drains, handholes, and manholes are easily accessible. 46. Air receivers are equipped with drainpipes and valves for removal of accumulated oil and water. 47. Air receivers are equipped with indicating pressure gauges. 49. Safety, indicating, and controlling devices are installed as required. 50. Safety valves are tested frequently and at regular intervals to assure good operating condition. 				

HSE Self-Assessment Checklist—HAND AND POWER TOOLS Page 3 of 4				
<u>SECTION 2 (continued)</u>	Ves No N/A N/O			
 LIQUID FUEL-POWERED TOOLS (5.2.6) 51. Liquid fuel-powered tools are stopped when refueling, servicing, or maintaining. 52. Liquid fuels are stored, handled, and transported in accordance with SOP HSE-403 53. Liquid fuel-powered tools are used in confined spaces in accordance with SOP HSE-203. 54. Safe operating pressures of hoses, valves, pipes, filters, and other fittings are not exceeded. 				
 POWDER-ACTUATED TOOLS (5.2.7) 55. Only trained employee operates powder-actuated tools. 56. Powder-actuated tools are not loaded until just prior to intended firing time. 57. Tools are not pointed at any employee at any time. 58. Hands are kept clear of open barrel end. 59. Loaded tools are not left unattended. 60. Fasteners are not driven into very hard or brittle materials. 61. Fasteners are not driven into easily penetrated materials unless suitable backing is provided. 62. Fasteners are not driven into spalled areas. 63. Powder-actuated tools are not used in an explosive or flammable atmosphere. 64. All tools are used with correct shields, guards, or attachments recommended by manufacturer. 				
 JACKING TOOLS (5.2.8) 65. Rated capacities are legibly marked on jacks and not exceeded. 66. Jacks have a positive stop to prevent over-travel. 67. The base of jacks are blocked or cribbed to provide a firm foundation, when required. 68. Wood blocks are place between the cap and load to prevent slippage, when required. 69. After load is raised, it is cribbed, blocked, or otherwise secured immediately. 70. Antifreeze is used when hydraulic jacks are exposed to freezing temperatures. 71. All jacks are properly lubricated. 72. Jacks are inspected as required. 73. Repair or replacement parts are examined for possible defects. 74. Jacks not working properly are removed from service and repaired or replaced. 75. Wrenches are not used when jaws are sprung to the point of slippage. 76. Impact tools are kept free of mushroomed heads. 77. Wooden handles of tools are kept free of splinters or cracks and are tightly fitted in tool. 78. Cutting tools maintained and used following requirements in AHA or procedure 				
 CHAIN SAWS (5.2.10) 79. Chainsaw equipped with spark arrestor and fully functioning chain brake 80. Chainsaw operator's manual readily available 81. Fully stocked first aid kit and multipurpose fire extinguisher available 82. Appropriate personal protective equipment available and worn 83. Clothing free of loose edges that could become entangled in the saw 84. Chainsaw handles kept dry, clean, and free of oil or fuel mixture 85. Chainsaws held firmly with both hands and used right-handed 86. Operator standing to the left of the saw out of the plane of the chain 87. Saw used between the waist and mid-chest level 88. Full throttle maintained while cutting 89. Operator aware of position of guide bar tip, does not contact tip with anything being cut 90. Bumper spikes maintained as close to the object as possible 91. Operator aware of what is in the saw's downward path after the cut 92. No attempt made to cut material that is larger than the guide bar of the saw 93. Cuts avoided that will cause chain to jam 94. Non-metallic wedges used to prevent compression cuts from jamming the blade 95. Bystanders and helpers kept at a safe distance from operation 96. Chainsaw not operated when fatigued 96. Fire extinguisher present when operating the chainsaw in forest or brushy areas 				

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HSE Self-Assessment Checklist – HAND AND POWER TOOLS

Page 4 of 4

SECTION 3

Complete t	plete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.				
Item #	Corrective Action Planned/Taken	Date Corrected			
Auditor:	Project Manager:				

HSE Self-Assessment Checklist: HAZARDOUS MATERIALS HANDLING

Page 1 of 3

This checklist is provided as a method of verifying compliance with regulations pertaining to the handling of hazardous materials. It shall be used at locations where CH2M HILL employees handle hazardous materials, or are required to perform oversight of subcontractor personnel handling hazardous materials, or both.

CH2M HILL staff shall not direct the means and methods of subcontractor operations nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies, and CH2M HILL staff must carefully rely on the subcontractor's expertise. Items considered imminently dangerous (possibility of serious injury or death) must be corrected immediately, or all exposed personnel must be removed from the hazard until it is corrected.

Project Name:	DM.	Project No.:
Auditor:	PM:	Date:
This specific checklist has been completed to (check of	only one of the boxes below):	:
 Evaluate CH2M HILL compliance with hazardou Evaluate a CH2M HILL subcontractor's complia Subcontractor's Name: 	is material handling requirem nce with hazardous material i	ents (SOP HSE-403) requirements

• Check "Yes" if an assessment item is complete or co	rrect.
---	--------

• Check "N/A" if an item is not applicable.

• Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-403.

	SECTION 1	Yes	No	N/A N/O	
Gl	ENERAL GUIDELINES (5.2)				
1. 2. 3. 4. 5. 6.	Acids are stored away from bases. Oxidizers and organics are stored away from inorganic reducing agents. Flammables and corrosives are stored in appropriate storage cabinets. Paper and other combustibles are not stored near flammables. Secondary containment and lipped shelving are in place in storage areas. A fire suppression system is available.				
FI Gl	AMMABLE AND COMBUSTIBLE LIQUIDS (5.3) ENERAL STORAGE (5.3.1)				
7. 8. 9. 10	Only approved containers/portable tanks used to store flammable and combustible liquids. Approved safety cans used for handling flammable liquids in quantities 1-5 gallons. For quantities of one gallon or less, the original container must be used for storage. Flammable or combustible liquids are not stored in stairways or personnel passageways.				

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HSE Self-Assessment Checklist: HAZARDOUS MATERIALS

Page 2 of 3

SECTION 1 (continued)	Yes	No	N/A N/O	
INDOOR STORAGE (5.3.2)				
 Quantities of flammable or combustible liquids > 25 gallons stored in approved storage cabinet. No more than 25 gallons of flamm. or comb. liquids can be stored outside an approved cabinet. Cabinets are labeled with "FLAMMABLE: KEEP FIRE AWAY." No more than 60 gallons of flamm. or 120 gallons of comb. liquids stored in one storage cabinet. Not more than three cabinets located in a single storage area. 				
OUTSIDE STORAGE (5.3.3)	_	_		
 Storage of containers (not more than 60 gallons each) do not exceed 1,100 gallons in any area. Storage areas are not within 20 feet of any building. Storage areas graded to divert spills away from buildings and surrounded by an earth dike. Storage areas are free from weeds, debris, and other combustible materials. Outdoor portable tanks are provided with emergency vent devices. Outdoor portable tanks are no closer than 20 feet from any building. Signs indicating no smoking are posted around the storage area. 				
DISPENSING (5.3.4)				
 Areas where liquids are dispensed in >5-gal quantities are separated from other operations by 25'. Drainage or other means provided to control spills. Adequate natural or mechanical ventilation provided to maintain concentration of flammable vapor < 10% of the lower flammable limit. Dispensing of flammable liquids from one container to another is done only when containers are electrically interconnected (bonded). Dispensing flammable or combustible liquids by means of air pressure on the container or portable tanks prohibited. Dispensing devices and nozzles for flammable liquids are of an approved type. 				
USE (5.3.5)				
29. Flammable liquids are kept in closed containers when not in actual use.30. Leakage or spillage of flammable or combustible liquids is disposed of promptly and safely.31. Sources of ignition are kept at least 50 feet from flammable liquids.				
LIQUID PETROLEUM GAS (5.4)				
 LPG containers meet DOT requirements. Each container or system has a safety relief device or valve in good working order. Portable heaters using LPG have an automatic shutoff device in the event of flame failure. Storage of LPG within buildings is prohibited. LPG storage location has at least one portable fire extinguisher rated not less than 20-B:C. 				
COMPRESSED GAS CYLINDERS (5.5) GENERAL (5.5.1)				
 37. Cylinders and apparatus inspected for defects and leakage prior to use. Damaged items not used. 38. Gas distributor notified and subsequent instructions followed for defective cylinders. 39. Leaking cylinders removed from the work area. 40. Cylinder users do not modify, tamper, or attempt repair on cylinders or apparatus. 41. Only cylinder owners or authorized agent refill cylinders or attempt to mix gases in a cylinder. 42. Cylinders labeled with the identity of the contents. 				

HSE Self-Assessment Checklist: HAZARDOUS MATERIALS

	SECTION 1 (continued)	Yes	No	N/A N/O	
TR	ANSPORTING (5.5.2)				
43. 44. 45. 46.	Cylinders not rolled in the horizontal position or dragged; suitable material-handling device used. Cylinders being transported have valve protection caps installed. Cylinders in vertical position when transported by motor vehicle, hoisted, or carried. Cylinders hoisted by a cradle or pallet designed for such use, and not by magnets, slings, or their valve protection caps.				
ST	ORAGE (5.5.3)				
47. 48. 49. 50. 51. 52. 53. 54.	Cylinders are stored in the vertical position with valve protection caps installed. Cylinders are secured from being knocked over by a chain or other stabilizing device. Cylinders are stored away from readily ignitable substances. Cylinders are protected from exposure to temperature extremes. Oxygen cylinders in storage are separated from fuel gas cylinders or combustible materials > 20' or by a ¹ / ₂ -hour fire-resistant barrier at least 5' high. Cylinders inside buildings are stored in dry, well-ventilated locations > 20' from comb. materials. Cylinders are stored in definitely assigned places away from elevators, stairs, or gangways. Signs indicating no smoking are provided for storage areas containing flammable gas cylinders.				
PL	ACEMENT FOR USAGE (5.5.4)				
55. 56. 57. 58. 59.	Cylinders are located where they will not be knocked over or damaged. Cylinders are secured in the vertical position. Cylinders are not placed where they can become part of an electrical circuit. Cylinders are kept far enough away from welding and cutting operations to prevent sparks, hot slag, or flames from reaching them. When impractical, fire resistant shields are provided. Cylinders are not taken into confined spaces.				
CY	LINDER CONNECTIONS (5.5.5)				
 60. 61. 62. 63. 64. 65. 66. 67. 	Pressure-controlling apparatus is compatible with the particular gas used. Cylinders and pressure-controlling apparatus are kept free of oil and grease. Pressure-controlling apparatus is kept gastight to prevent leakage. Cylinders not attached to process where backflow could occur unless check valves or traps used. Manifolds designed for product used at the appropriate temperatures, pressures, and flow rates. Manifolds are labeled and placed in well-ventilated and accessible locations. Cylinders are not cross-connected with plant air lines. Flash arrestors or reverse flow check valves are installed on all flammable gas cylinders.				
US	AGE (5.5.6)				
 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 	Eye protection (safety glasses or goggles) is worn when using cylinders. Cylinder valve and regulator are inspected for foreign material before connecting. If cylinders are frozen, warm (not boiling) water is used to thaw cylinders. Cylinder valve remains closed except when the cylinder is in use. Fuel gas cylinder valves are not opened more than $1\frac{1}{2}$ turns, for quick closing. If a special wrench is used to open a cylinder valve, it is left in position on the valve. Acetylene cylinders are used in the vertical position. Acetylene cylinders are not used > 15 psig or > 30 psia. Copper pipe or fittings are not used with acetylene systems. Compressed gas is not used to dust off clothing. Cylinder valve closed and regulator relieved of internal pressure before regulators are removed.				

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HEAT STRESS PHYSIOLOGICAL MONITORING FORM

Project Name:

Date:

Company:

- 1. Record start and stop time for break, pulse at the beginning of your break and a second pulse 60 seconds later, fluid intake (water or electrolyte replacement), shade (Y/N) and A/C (Y/N).
- 2. Follow the Physiological Monitoring Protocol in the attached safety bulletin or FSI.
- 3. Never continue work if you are experiencing sudden and severe fatigue, nausea, dizziness, or lightheadedness, immediately call your Field Lead/Safety Coordinator/RHSM.

Employee:

Describe action taken if heart rate measurements are exceeded:

Start	Stop	Start	Stop	Start	Stop	Start	Stop

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

Employee:

Describe action taken if heart rate measurements are exceeded:

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop			
Pulse											
Fuilds											
Shade											
A/C											
Employee:	Employee:										
Describe action	Describe action taken if heart rate measurements are exceeded:										

Time	Start	Stop	Start	Stop	Start	Stop	Start	Stop
Pulse								
Fuilds								
Shade								
A/C								

HSE Self-Assessment Checklist—Lifting

This checklist shall be used **only** by CH2M HILL personnel and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where: (1) CH2M HILL employees perform manual lifting activities (office or projects), and/or (2) CH2M HILL provides oversight of a subcontractor performing manual lifting activities. SC or Office Safety Coordinators/Committee members may consult with subcontractors (if applicable) when completing this checklist but shall not direct the means and methods of activities nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies, and we must carefully rely on their expertise. Conditions considered imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazardous area until corrected. Complete the appropriate project or office information:

Proj	ect Information				
Proje	ect Name: Project No	0.:			
Loca	tion: PM:				
Audi	itor: Title:	1	Date:		
Offic	ce Information				
Offic	ce Location:				
Audi	tor: Title:]	Date:		
This This O	specific checklist has been completed to: Evaluate CH2M HILL employee manual lifting activities. Evaluate a CH2M HILL subcontractor's manual lifting activities. Subcontractor Name:	e immec	 liate atte	ention o I Operat	f the
Plan	ning Activities	Yes	<u>No</u>	<u>N/A</u>	<u>N/O</u>
1.	Efforts have been made to inquire about receiving equipment or supplies in containers weighting less than 50 pounds (23 kilograms).	0	0	0	0
2.	Equipment or supplies are being delivered as close as possible to their use point.	0	0	0	0
3.	Heavy equipment or supplies are being stored off the ground and no lower than knee height.	0	0	0	0
4.	Adequate space has been provided to access and lift equipment or supplies without reaching or twisting.	0	0	0	0
Safe	Work Practices (5.1)	Yes	No	<u>N/A</u>	<u>N/O</u>
5.	Tasks or activities have been modified to reduce or minimize manual lifting.	0	0	0	0
6.	All employees performing manual lifting have received training on how to lift safely.	0	0	0	0
7.	Manual lifting control measures are evaluated during assessments.	0	0	0	0

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2 2

8.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	0	0	0	0
9.	Manual lifting incidents are reviewed as part of the HSE Program reviews.	0	0	0	0
Off	ice Environments (5.1.1)	<u>Yes</u>	<u>No</u>	<u>N/A</u>	<u>N/O</u>
10.	Employees have received lifting training.	0	0	0	0
11.	Mechanical devices are readily available to employees handling equipment or supplies weighing more than 40 pounds (18 kilograms).	0	0	0	0
Fiel	d Projects (5.1.2)	Yes	<u>No</u>	<u>N/A</u>	<u>N/O</u>
12.	All manual lifting tasks or activities have been addressed in the written site safety plan.	0	0	0	0
13.	Employees have received safe lifting training as required by the written site safety plan.	0	0	0	0
Mec	hanical Lifting (5.2)	Yes	<u>No</u>	<u>N/A</u>	<u>N/O</u>
14.	Hand trucks and trolleys are visually inspected before use.	0	0	0	0
15.	Hand trucks and trolleys do not have any broken or damaged parts.	0	0	0	0
16.	Hand truck and trolley paths are free of uneven surfaces, water, oil, or cracks and holes.	0	0	0	0
17.	Loads carried by hand trucks are balanced and sturdy.	0	0	0	0
18.	Hand trucks or dollies are being pushed when on level ground.	0	0	0	0
19.	When going up or down a slope using a hand truck or trolley, the load is downslope of the person.	0	0	0	0
20.	Employees using hand trucks or dollies are moving slowly and cautiously.	0	0	0	0
21.	Employees using hand trucks or trolleys are able to see over the load.	0	0	0	0
Ass	isted Lifting (5.3)	Yes	<u>No</u>	<u>N/A</u>	<u>N/O</u>
22.	Personnel are not performing manual lifting beyond their physical capabilities.	0	0	0	0
23.	Loads are evenly distributed when being handled by multiple people.	0	0	0	0
Mai	nual Lifting (5.4)	Yes	<u>No</u>	<u>N/A</u>	<u>N/O</u>
24.	Before the lift, the load and path was assessed.	0	0	0	0
25.	Loads being lifted are free of sharp edges, slivers, or wet or greasy spots.	0	0	0	0
26.	Gloves are used for manual lifts of loads with sharp or splintered edges.	0	0	0	0
27.	Employees performing manual lifts use the proper lifting techniques.	0	0	0	0
28.	Special tools fabricated for lifting grates or manhole covers are used.	0	0	0	0

Item		Date
#	Corrective Action Planned/Taken	Corrected
<u> </u>		

Auditor: _____ Project Manager: _____

HSE Self-Assessment Checklist – LOCKOUT/TAGOUT

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's written safety plan.

This checklist is to be used when: 1) CH2M HILL staff are exposed to lockout/tagout hazards (complete Section 1), 2) CH2M HILL staff are self-performing lockout/tagout activities (completed Section 2), or 3) CH2M HILL provides oversight of subcontractor personnel who are performing lockout/tagout activities (complete Sections 1 and 2).

Safety Coordinator may consult with subcontractors when completing this checklist, but shall not direct the means and methods of lockout/tagout operations nor direct the details of corrective actions. Subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately, or all exposed personnel shall be removed from the hazard until corrected.

Project Name:		Project No.:	
Location:		PM:	
Auditor:	Title:		_ Date:
This specific checklist has been completed to: Evaluate CH2M HILL affected employee Evaluate CH2M HILL authorized employ Evaluate a CH2M HILL subcontractor's c Subcontractors Name: 	exposure to equipment during ree exposure to equipment requipment requipment requipment requipment requipment requires the second secon	g lockout/tagout uiring lockout/tagout it requirements	

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard Operating Procedure HSE-310.

	SECTION 1				
SA	FE WORK PRACTICES (5.4)	Yes	No	N/A	<u>N/O</u>
1. 2. 3. 4. 5. 6. 7.	Only trained and authorized personnel are performing lockout/tagout activities All affected employees notified prior to lockout/tagout activities Equipment has been shutdown using normal operating controls Employees do not attempt to start, energize or use equipment that is locked out or tagged Employees do not remove locks or tags placed on equipment by other personnel Affected employees are notified after lockout/tagout is completed Employees verify that all safe guards have been replaced prior to equipment start-up				

HS	E Self-Assessment Checklist – LOCKOUT/TAGOUT		Page 2 of 3		
	SECTION 2	Yes	No	N/A	<u>N/O</u>
GE	NERAL (5.5.1)				
8. 9. 10. 11. 12.	Only trained and authorized personnel are performing lockout/tagout activities Daily safety briefing/meeting conducted with affected and authorized employees Employees made aware of any equipment-specific lockout/tagout procedures Authorized employees provided with lockout devices, locks, tags and other isolation devices New or modified equipment designed to accept lockout devices				
EQ	UIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURES (5.5.2)				
 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 	LOTO procedures available when required to be documented Equipment-specific LOTO procedures developed when not available from the facility Affected employees notified that equipment will be shut down for LOTO Energy sources, hazards, and control measures determined Orderly shutdown of equipment is conducted that does not increase hazards Energy isolating devices operated to isolate energy sources Authorized employees apply personal lockout devices and tags to energy isolating device Lockout devices are applied to secure equipment in the "off" position Lockout tags applied to clearly indicate that operating the equipment is prohibited Tags are located as close to or at the energy isolating device All hazardous stored or residual energy is relieved, disconnected or restrained. Isolation of energy sources has been verified (tested) prior to of work on equipment Lockout tags are used alone only where lockout devices cannot be applied				
LO	CKOUT DEVICES AND TAGS (5.5.4)				
26. 27. 28. 29. 30. 31. 32. 33.	Lockout devices and tags only used to isolate energy sources Lockout devices and tags are standardized by color, shape, size, print, and format Lockout devices and tags indicate identity of employee applying the devices Lockout devices and tags capable of withstanding anticipated environmental conditions of use Lockout devices are substantial enough to prevent removal without the use of excessive force Tags and their means of attachment are substantial enough to prevent inadvertent removal Tags are legible and understandable by all employees Tags warn against hazardous conditions if equipment is energized				
RE 34. 35. 36.	LEASING LOTO CONTROL (5.5.5) Work area inspected prior to removing LOTO devices and reenergization LOTO devices only removed by authorized employees who applied the device If employee not available to remove LOTO devices, steps in Section 4.2.4 of SOP followed				
37.	All affected employees notified prior to starting equipment previously locked or tagged out				
GR 38. 39. 40. 41. 42. 43.	OUP LOTO (5.5.6) Group LOTO procedures followed when more than one employees is to work on equipment Primary authorized person assigned to coordinate LOTO process Normal steps for initiating LOTO control completed as above Primary authorized person applies own lockout device and tag Each authorized person applies own lockout device and tag Primary authorized person removes LOTO devices after all other LOTO devices are removed				
SP 44. 45.	ECIAL CONDITIONS (5.5.7) Shift or personnel changes coordinated to ensure LOTO protection is always provided Procedures followed when LOTO devices are temporarily removed to test or reposition				

HSE Self-Assessment Checklist – LOCKOUT/TAGOUT

Page 3 of 3 _____

SECTION 3

Comp	Complete this section for all items checked "No" in Sections 1 or 2. Deficient items must be corrected in a timely manner.						
Item #	Corrective Action Planned/Taken	Date Corrected					

Attachment 3 Equipment-Specific Lockout/Tagout Procedure Development Form

Page 1 of 2

EQUIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURE DEVELOPMENT FORM

Project name:	Project No.:
Equipment identity (name, number, etc.):	
Equipment location:	
Authorized employee that developed this procedure:	Date:

Purpose

This procedure shall be used by CH2M HILL to establish the minimum requirements for the lockout/tagout of energy isolating devices whenever servicing and maintenance activities are performed on the above equipment. It shall be used to ensure that the equipment is stopped, isolated from all potentially hazardous energy sources and locked out and tagged before employees perform any servicing and maintenance where the unexpected energization, start-up of the equipment, or release of stored energy could cause injury.

Compliance With This Procedure

All employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout/tagout. The authorized employees are required to perform the lockout/tagout in accordance with this procedure. All employees, upon observing equipment that is locked/tagged out shall not attempt to start, energize, or use the equipment.

Authorized Employee

Specific servicing and maintenance activity to be performed

Sequence of Initiating Lockout/Tagout Control

1) Notify all affected employees that servicing and maintenance is required and that the equipment must be shut down and this lockout/tagout procedure implemented.

Affected Employee(s) Notified

2) Authorized employee(s) shall identify the type and magnitude of the energy that the equipment uses, and shall understand the hazards and the methods to control the energy.

Energy Sources	<u>Magnitude</u>	<u>Hazards</u>	Control methods

3) If the equipment is operating, shut it down by the normal stopping procedures listed below.

Equipment shutdown steps:

4) Locate and operate energy isolating device(s) to isolate the equipment from the energy source(s).

Isolated

Energy Isolating Device

Location

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EQUIPMENT-SPECIFIC LOCKOUT/TAGOUT PROCEDURE DEVELOPMENT FORM

Authorized employee(s) shall apply their personal lockout device and tag to each energy isolating device. 5) Lockout devices and tags shall meet the requirements provided in Section 5.5.4 of the Lockout/Tagout SOP 310. When servicing and maintenance activities are to be performed by more than one authorized employee, a primary authorized employee shall be identified and a group lockout/tagout process shall be used that meets the requirements provided in Section 5.5.6 of the Lockout/Tagout SOP 310.

Primary Authorized Employee: _____ Phone No.: _____

Stored or residual energy shall be dissipated or restrained 6)

Type(s)	of	stored	energy
_				

Methods to dissipate or restrain

Authorized employee(s) shall verify that isolation of the equipment has been completed by trying to operate 7) the equipment using normal operating control(s) or by testing to verify that the equipment will not operate. Control(s) shall be returned to the neutral or "off" position after isolations are verified.

Method(s) used to verify equipment isolation:

Sequence of Releasing Lockout/Tagout Control

- Verify that all personnel in the work area are in a safe position. 1)
- Ensure all nonessential items have been removed and equipment components are operationally intact, 2) including the proper reattachment of all equipment safe guards.
- Verify that the controls are in neutral or "off" position. 3)
- 4) Each lockout device and tag shall be removed from each energy isolating device by the authorized employee who applied the devices. If an authorized employee is unavailable to remove their device, the requirements provided in Section 5.5.5 of the Lockout/Tagout SOP 310, shall be followed.
- 5) All affected employees shall be notified that the lockout devices and tags have been removed before starting the equipment.

Special Conditions

Shift or personnel changes made during servicing and maintenance activities shall be coordinated to ensure lockout/tagout protection is always provided, including the orderly transfer of lockout devices and tags between off-going and oncoming authorized employees.

Method(s) of lockout/tagout control transfer: _____

When lockout devices and tags must be temporarily removed from the energy isolating device and the equipment energized to test or reposition the equipment, the following sequence shall be followed:

- 1) Clear equipment of tools and materials and remove all employees from the equipment area.
- 2) Remove only the lockout devices and tags needed to energize the equipment for testing or repositioning.
- Energize and proceed with testing or repositioning. 3)
- 4) Deenergize the equipment and reapply the lockout devices and tags to continue the servicing and maintenance activities.

Other Requirements: _____

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HSE Self-Assessment Checklist: PPERSONAL PROTECTIVE EQUIPMENT

This checklist shall be used by CH2M HILL personnel only and shall be completed at the frequency specified in the project's HSP/FSI.

This checklist is to be used at locations where CH2M HILL employees are required to wear PPE or are required to perform oversight of a subcontractor using PPE or both.

CH2M HILL staff shall not direct the means and methods of subcontractor use of PPE nor direct the details of corrective actions. The subcontractor must determine how to correct deficiencies and CH2M HILL staff must carefully rely on their expertise. Conditions considered to be imminently dangerous (possibility of serious injury or death) must be corrected immediately or all exposed personnel must be removed from the hazard until corrected.

Project Name:	Project No.:									
Location:	PM:									
Auditor:	Title:	Date:								
This specific checklist has been completed to (check only one of the boxes below):										
 Evaluate CH2M HILL compliance with its PPE program (SOP HSE-117) Evaluate a CH2M HILL subcontractor's compliance with its PPE program Subcontractor's Name: 										
Check the appropriate box, as follows:										
• Check "Yes" if an assessment item is a	complete or correct.									
• Check "No" if an item is incomplete of	r deficient. Section 2 must be completed for	or all items	check	ed "N	o."					
• Check "N/A" if an item is not applicable	le.									
• Check "N/O" if an item is applicable b	ut was not observed during the assessment	t.								
Numbers in parentheses indicate where a d Procedure HSE-117.	escription of this assessment item can be for	ound in St	andard	Opera	ating					
SECTION 1		Yes	No	N/A	<u>N/O</u>					
 Required PPE listed in HSP FSI or AE PPE available for use by employees. PPE cleaning supplies available for use PPE stored appropriately to prevent de PPE written certification has been com 	IA. e. formation or distortion. pleted.									
EYEWEAR (Glasses/Goggles/Face Shiel	ds)	_	_	_	_					
6 Eyewear cleaning supplies available.7 Safety glasses in good condition and least supplies available.	enses free of scratches.									
8 Goggles adjustment strap not cracked scratched.	or frayed, not deformed, or lenses not									
 Face shields in good condition, includi chips. 	ng adjustment band, and free of scratches	or								

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HSE Self-Assessment Checklist: PERSONAL PROTECTIVE EQUIPMENT

Page 2 of 3

SE	CTION 1 (Continued)	Yes	No	N/A N/O
HE	AD PROTECTION			
10.	Hard hat bill and suspension attached as allowed by manufacturer.			
11.	Shell is pliable, free of dents, cracks, nicks, or any damage due to impact.			
12.	Suspension maintained at 1.25 inches from inside of shell.			
13.	Suspension free of cuts or fraying, torn headband, adjustment strap workable.			
14.	Electrical hard hat matched to hazard classification.			
15.	Dated to determine whether within manufacturer's allowable 5-year use time period.			
HA	ND PROTECTION			
16.	Available in sizes matched to employee.			
17.	Gloves free of rips tears, abrasions, or holes.			
18.	Matched to manufacturer's specification for chemicals used onsite.			
19.	Electrical gloves matched to hazard and periodically inspected for insulating rating.			
20.	Maintained in a clean and sanitary condition, decontaminated or disposed properly.			
BO	DY PROTECTION			
21.	Available in sizes matched to employee.			
22.	Maintained in a clean and sanitary condition, decontaminated or disposed properly.			
23.	Vapor-tight fully encapsulated suits tested at required periodic intervals.			
24.	Flame-resistant clothing matched to electrical hazard and arc flash rating.			
25	Welding gear matched to degree of hazard and free of cuts, tears or burn holes.			
26	Flotation gear available for work near or on water and in good condition.			
но	T AND COLD BODY PROTECTION			
27	Cooling gear available based on degree of heat stress hazard.			
28	Cooling gear in operable, clean, and sanitary condition.			
29	Cold-weather gear provided based on needs assessment.			
30.	Cold-weather gear available in sizes to match employees.			
31	Cold-weather gear is in free of tears, rips, or holes and in maintained in a clean condition.			
TR	AINING			
32	Initial PPE training completed by employees.			
33	Training conducted when new types or styles of PPE are issued.		\Box	
34	PPE selection, use, and maintenance reviewed at daily safety briefings.		\Box	

Page 3 of 3 HSE Self-Assessment Checklist: PERSONAL PROTEECTIVE EQUIPMENT

SECTION 2

Complete this section for all items checked "No" in Section 1. Deficient items must be corrected in a timely manner.

Item	n					
#	Corrective Action Planned or Taken	Corrected				
ļ						
ļ						

Auditor: _____ Project Manager: _____

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CH2M HILL Health and Safety Plan Attachment 5

Key Target Zero Program Elements

(Blank forms for field use)

Project Health and Safety Field Change Request Log

Management Health, Safety, Security and Environment Inspection

Activity Hazard Analysis

Pre-Task Safety Plans

Safe Behavior Observation

Incident Report and Investigation (use electronic form when possible) <u>HITS</u>

Lessons Learned Template

Air Monitoring Form

Project Health and Safety Field Change Request Log

INSERT PROJECT NAME

FCR Number	Description of changes	Date of issue



Management Health, Safety, Security and Environment Inspection

Program/Project Name:		Vork I	Being	Perform	ned:
Management Inspector:			Proje	ect Num	ber:
Date:				Sec	ctor:
1. Job Information/Postings	Α	С	I	N/A	Comments/Corrective Action(s)
a. Required postings in place (OSHA/State/Country)					
b. Emergency Contacts and Phone list posted					
c. Directions and map to hospital posted					
d. Incident Reporting Flow Chart posted					
2. HSSE Documentation					
a. HASP current (within 1 year), onsite, and signed					
 AHAs available for all work and reviewed/signed 					
c. Daily Pre-Task Safety Plan/Meeting completed					
d. SBO's completed weekly and emailed					
e. Self-Assessment checklists completed per HASP					
f. Environmental Plan available					
g. Emergency drill completed and documented					
h. E Permit compliance assurance measures documented					
i. HSE training up to date and documented					
3. Housekeeping/First Aid					
a. Work areas clean and organized					
b. Fire extinguisher, eye wash, 1 st aid/BBP kit in place					
c. Materials and waste labeled and in closed containers					
4. PPE and Air Monitoring					
a. PPE being worn as specified in HASP/AHA					
b. Air monitoring done per HASP and documented					
5. Heavy Equipment and Construction Operations					
a. Documentation of Competent/Qualified Operators					
b. Back-up alarms audible & no cell phone use					
c. High-visibility vests on ground personnel					
d. Daily inspections completed and documented					
e. Windshields/mirrors OK and seat belts worn					
6. Excavation, Trenching, and Land Disturbing Activities					
a. Competent person identified					
b. Daily inspection completed prior to entry					
c. Proper setup (sloping, shoring, exits, spoils)					
d. 3 rd party Utility Locate service used					
d. Storm water PPP and inspections/sampling conducted					
d. Erosion/sediment controls and dust controls in place					
7. Hand Tools					
a. Hand tools inspected prior to use					
b. Guards in place on tools					
c. Right tool for the job at hand					
8. Electrical					
a. All electrical cords, prongs, receptacles OK					
b. GFCI used on all circuits					
c. No energized electrical work incl. voltage testing					
d. Written Lockout Tagout system in use					

(Column - A=Adequate, C=Needs Consideration, I=Needs Immediate Action, N/A= Not Applicable or Not Assessed)

9. Ladders and Scaffolds	Α	С	I	N/A	Comments/Corrective Action(s)
a. Ladders extend 36" above the landing and secured					
b. Ladders selected and used properly					
c. Scaffold planked, unaltered, and in good condition					
d. Scaffold/ladder users trained in inspection and use					
10. Hot Work					
a. Gas cylinders stored upright and secured					
b. Minimum 20' distance between fuels and oxygen					
c. PPE in use per HASP/AHA					
d. Fire watch in place w/adequate fire extinguishers					
11. Cranes					
a. Outriggers extended, swing radius protected					
b. Operator CCO licensed, competent person for rigging					
c. Annual certified crane inspection					
d. Chains and slings inspected, have rating tag					
e. Suspended load tag lines - no one underneath					
12. Drill Rigs				1 1	
a. Overhead electrical clearance adequate				Π	
b. Daily inspections completed and available					
c. Emergency shut off functioning					
d. 3 rd party Utility Locate service used					
13 Hazard Communication and Chemical Lise					
a. MSDS's present for all chemicals					
b. Chemical Inventory current and in HSP or on file					
c. Hazard communication briefing for all chemicals					
d. All chemicals labeled/stored as required					
e. SPCC Plan implemented for >1320 gals fuels/oils on site					
a Full body barness worn properly workers tied off over 6'					
h Guard rails 42" high					
15. Material Landling					
15. Material Handling				ГТ	
a. Proper body positioning					
16. Site Control				<u> </u>	
a. Work Zones delineated, necessary signage in place					
b. Decontamination method is adequate					
17. Waste and Hazardous Materials Management				<u>г г</u>	
a. Waste Tracking Log					
b. Hazardous waste onsite for <90 days					
c. Containers labeled, inspections conducted/documented					
d. HW manifests signed, tracked, copies kept on site					
e. HW Transporters trained and licensed, placards used					
18. Security and Emergency Planning			1	F F	
a. Emergency coordinator designated					
b. Severe weather plans/controls in place					
c. Security plan/measures adequate					
19. Demolition				, ,	
a. ACM and Hazardous Materials Survey					
b. Asbestos/Lead based paint work approved per policy					
(Column - A=Adeguate, C=Needs Consideration, I=Needs	Imme	ediate	Acti	on. N//	A= Not Applicable or Not Assessed)

ACTIVITY HAZARD ANALYSIS

Date:	Tas	k Risk Assessment	Code (RAC):						
Project:									
	L = Lov	N							
Site Supervisor:	E = Extremely High Risk								
Site Safety Coordinator:	H = High Risk				Frobability				
HSM Review/Approval:	M = Moderate Risk Frequent		Likely	Occasional	Seldom	Unlikely			
Job/Activity:	Catastrophic		Е	Е	Н	н	М		
Description of the work:	erity	Critical	Е	н	н	М	L		
	Seve	Marginal	н	М	М	L	L		
		Negligible	М	L	L	L	L		

TYPES OF POTENTIAL ENERGY:										
R	T-A	4		0 ^O	-\$-	\bigcirc		-W	***	
1	2	3	4	5	6	7	8	9	10	
BIOLOGICAL	CHEMICAL	ELECTRICAL	GRAVITY	MECHANICAL	MOTION	PRESSURE	RADIATION	SOUND	TEMPERATURE	

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to EN&N Market HSSE Handbook for required controls)

Work Task Sequence (List steps you need to take to complete the activity.)	Potential Health and Safety Hazards (How can you be harmed? Cut, struck, exposed)	Potential Energy(ies) Associated with Task	Hazard Controls (List the specific controls for each potential hazard. Refer to EN&N Market HSSE Handbook for required controls)

Equipment to be used (List equipment to be used in the work	Inspection Requirements (List inspection requirements for the work	Training Requirements (List training requirements including hazard

ACTIVITY HAZARD ANALYSIS

	PRINT NAME	<u>SIGNATURE</u>	
Supervisor Name:			Date/Time:
Safety Officer Name:			Date/Time:
Employee Name(s):			Date/Time:

Pre-Task Safety Plan (PTSP) and Safety Meeting Sign-in Sheet

Project:	Location:	Date:						
Supervisor:	pervisor: Job Activity:							
Attendees: Print Nat	me	Sign Name						
List Tasks and verify that applica	hle AHAs have been reviewed.							
List fusits and verify that applied								
Tools/Equipment Required for T	asks (ladders, scaffolds, fall protection	on cranes/rigging heavy equipment nower						
tools):	asks (ladders, scartolds, fait protection	on, cranes/ ngging, neavy equipment, power						
Potential H&C Hazarda includin	a chamical physical safety higlogic	and any ironmontal (shack all that apply)						
rotentiai mos mazarus, including	g chemical, physical, safety, biologic	ai and environmental (check an that apply).						
Chemical burns/contact	Trench, excavations, cave-ins	Ergonomics						
Pressurized lines/equipment	Overexertion	Chemical splash						
Thermal burns	Pinch points	Poisonous plants/insects						
Electrical	Cuts/abrasions	Eye hazards/flying projectile						
Weather conditions	Spills	Inhalation hazard						
Heights/fall > 6 feet	Overhead Electrical hazards	Heat/cold stress						
Noise	Elevated loads	Water/drowning hazard						
Explosion/fire	Slips, trip and falls	Heavy equipment						
Radiation	Manual lifting	Aerial lifts/platforms						
Confined space entry	Welding/cutting	Demolition						
Underground Utilities	Security	Poor communications						
Other Potential Hazards (Describ	e):							

Hazard Control Measures (Check All That Apply):						
PPE	Protective Systems	Fire Protection	Electrical			
Thermal/lined	Sloping	Fire extinguishers	Lockout/tagout			
Eye	Shoring	Fire watch	Grounded			
Dermal/hand	Trench box	Non-spark tools	Panels covered			
Hearing	Barricades	Grounding/bonding	GFCI/extension cords			
Respiratory	Competent person	Intrinsically safe equipment	Power tools/cord			
Reflective vests	Locate buried utilities		inspected			
Flotation device	Daily inspections		Overhead line clearance			
Hard Hat	Entry Permits/notification		Underground utils ID'd			
Safety-Toed Boots	-					
Fall Protection	Air Monitoring	Proper Equipment	Welding & Cutting			
Harness/lanyards	PID/FID	Aerial lift/ladders/scaffolds	Cylinders secured/capped			
Adequate anchorage	Detector tubes	Forklift/heavy equipment	Cylinders			
Guardrail system	Radiation	Backup alarms	separated/upright			
Covered opening	Personnel sampling	Hand/power tools	Flash-back arrestors			
Fixed barricades	LEL/O2	Crane with current	No cylinders in CSE			
Warning system	No visible dust	inspection	Flame retardant clothing			
	Other	Proper rigging	Appropriate goggles			
		Operator qualified				
Confined Space Entry	Medical/ER	Heat/Cold Stress	Vehicle/Traffic			
Isolation	First-aid kit	Work/rest regime	Traffic control			
Air monitoring	Eye wash	Rest area	Barricades			
Trained personnel	FA-CPR trained personnel	Liquids available	Flags			
Permit completed	Route to hospital	Monitoring	Signs			
Rescue		Training				
Permits	Demolition	Inspections:	Training:			
Hot work	Pre-demolition survey	Ladders/aerial lifts	Hazwaste (current)			
Confined space	Structure condition	Lanvards/harness	Construction			
Lockout/tagout	Isolate area/utilities	Scaffolds	Competent person			
Excavation	Competent person	Heavy equipment	Task-specific			
Demolition	Hazmat present	Drill rigs/geoprobe rigs	FA/CPR			
Energized work		Cranes and rigging	Confined Space			
		Utilities marked	Hazcom			
The demonstrate of Thilities	In eident Communications					
Disclored Utilities	Incident Communications	AHA S	N			
Dig alert called	TM/CM	reviewed and approved by HS				
3 rd Party locater	Immediate calls to TM/CM	on site and current				
AS-DUIITS reviewed	Client notification	applicable for this day s work				
interview site staff	24 hour potification sotup	Communication and incident p	processes included?			
Client review	Clear communications					
soft locate necessary?						
Field Notes (including c	bservations from prior day, e	tc.):				

Name (Print): ______ Signature:_____

Date:_____

	Safe	Behavi	or Observation Form			
Federal Commercial (check one) International			Construction or Consulting (check one)			
Project Number (required):		Client/	Program:			
Project Name:		Observ	er:	Date:		
Position/Title of worker observed:			Background Information/ comments:			
Task/Observation Observed:						
 Identify and reinforce safe work Identify and improve on at-risk Identify and improve on practic Proactive PM support facilitates Positive, corrective, cooperative 	c practic practice es, conc s elimina e, collab	es/beha s/acts litions, c ating/red orative f	riors ontrols, and compliance that elin ucing hazards (do you have wha eedback/recommendations	ninate or reduce hazards t you need?)		
Actions & Behaviors	Safe	At- Risk	Observations/	Comments		
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			Positive Observations/Safe V	Vork Practices:		
Properly trained/qualified/experienced						
Tools/equipment available and adequate						
Proper use of tools			Questionable Activity/Unsafe	Condition Observed:		
Barricades/work zone control						
Housekeeping						
Communication						
Work Approach/Habits						
Attitude						
Focus/attentiveness			Observer's Corrective Action	s/Comments:		
Pace						
Uncomfortable/unsafe position						
Inconvenient/unsafe location						
Position/Line of fire						
Position/Line of fire						
Position/Line of fire Apparel (hair, loose clothing, jewelry)						
Position/Line of fire Apparel (hair, loose clothing, jewelry) Repetitive motion			Observed Worker's Correctiv	ve Actions/Comments:		

For ES Federal Sector projects please email completed forms to: <u>CH2M HILL ES FED Safe Behavior Observation</u> For ES Commercial Sector projects please email completed forms to: <u>CH2M HILL ES COM Safe Behavior Observation</u> For CNR ES staff please email completed forms to: <u>cnressafe@ch2m.com</u> For International ES projects please e-mail completed forms to: <u>ESINTLSafeBehaviorObservation@ch2m.com</u>

HITS Incident Report Hardcopy (Phase 1 – Initial Entry)

Phase	1 – Initial Entry	. nope				,,,
Type of I	ncident (May select more than one)					
	Injury/Illness		Spill/Release			Near Miss
	Property Damage		Environment/Permit			Other
General	Information Section					
Preparer	's Name:		Prepa	rer's Phone Number	:	
Date of I	ncident:	Time of Ir	ncident:	AM / PM		
What Bu	siness Group is accountable for this in	cident:				
What Bu	siness Group SubGroup is accountable	e for this i	ncident:			
What CH	2M HILL Company is accountable for t	his incide	nt:			
Where d	id the Incident occur?					
	United States, Geographic Region:					
	Canada, Province/Territory:					
	International, County:					
Location	of Incident?					
	Company Premises, CH2M HILL Office (use 3 lette	er office code if availabl	e):		
	Project, Project name:					
	In Transit					
	Traveling from:					
	Traveling to:					
	At Home					
	Other, Specify:					
Describe	the incident:					
Describe	how this event could have been preve	nted:				
Provide	Witness Information:					
Nan	ne:			Phone:		
Nan	ne:			Phone:		
Nan	ne:			Phone:		
Personn	el Notified of Incident (Provide name, d	ate and ti	me):			
	CH2M HILL Personnel:					
	Client Personnel:					
Addition	al Comments:					
In:	and Section IComplete only if Inium/III	ann Innid	ant turns as leasted]			
	inium do	iess inclu	ent type selected]			
wno was	Sinjured?					
	CH2M HILL Employee or CH2M HILL Te		byee			
	Subcontractor to CH2M HILL (Non-LLC	Joint Venti	ure Project)			
	LLC Joint Venture Partner Employee					
	LLC Joint Venture Project Subcontractor	/Contracto	r			
	Utner			1.1. 714		
Name of	injurea:					
⊨mploye	r Name:		Sup	ervisor of Employe	e:	
Complet	e tor CH2M HILL Employee Injuries					
Bu	siness Group of Injured Employee:					
На	s the employee called the Injury Manag	ement Ac	Iministrator (1-866-89	3-2514)?		
	L Yes	No		ot Sure		
На	s the injured employee's supervisor be	en notifie	d of this incident?			
			20			

		Yes		No		Not Sure			
Complete f	or Non			ricc					
Complete for Non-CH2M HILL Employee Injuries									
	ne proj T			No		Not Sure			
Proie	_ ct Safo	ty Coordinate		NO		Not Ourc			
Pody Port /	Affector	ay Coordinate	л						
		u:							
Deceribe tr	ss (Res	uit):	modioation n	rovidod ido	ntify whathar ava	r the counter or pr			
Describe th	eatmen	it provided (if	medication p	rovided, ide	ntiry whether ove	r-the-counter or pre	escription):		
Describe ar	ny work	c restriction p	rescribed (inc	lude dates	and number of da	ys):			
Physician/H	lealth (Care Provider	Information						
Name							Phone:		
was treatm	ent pro	ovided away f	rom the works	site ?					
	0								
	es								
		Facility Name	9:						
		Address:							
		City:					Phone Number:		
	d treate	d in an emerg	gency room?						
	0		Yes In ht op on in n						
	a nospi		ight as an in-p	Datient?					
	0		Yes						
General Info Who had co C S S S S S S R	ormatic ontrol o H2M HI ubcontr bint Ven ther, Co elations	on Environme of the area du LL, Company: actor, Compar ture Partner/C ompany: ship to CH2M I	ring the incide	Complete c	ompany:	ht/Permit or Spill/Re	elease Incident type selected]		
Property Da	amage	Section [Com	plete only if F	Property Dar	nage Incident typ	e selected]			
Property Da	maged:					-			
Property Ow	vner:								
Damage De	scriptio	n:							
Estimated U	IS Dolla	r Amount:							
Spill or Release Section [Complete only if Spill/Release Incident type selected]									
Estimated C	Quantity	:							
Did the spill	/release	e move off the	property?:						
Spill/Releas									
Spill/Releas	e To:								
opili/reliede	0 10								
Environmer Describe En	nt/Perm	nit Section [C ental or Permi	omplete only t Issue:	if Environm	ent/Permit Incider	nt type selected]			
Permit Type	:								
Permitted Le	evel or (Criteria (e.g., d	discharge limit)	: <u></u>					
Permit Nam	e and N	lumber (e.a I	NPDES No. ST	1234):					
Substance a	and Esti	mated Quanti	ty:	, <u> </u>					
Duration of Permit Exceedence:									


Lessons Learned

[Date] ESBG LL-11-xx

Subject	[Insert Descriptive Name of Lessons Learned]	
CH2M HILL Project?	[Yes or No]	
Situation	[Describe incident or situation that occurred in general terms. Try to be brief and avoid unnecessary details such as names of people or projects, business groups, divisions, dates, location, etc.]	
Lessons Learned (Recommendations and Comments)	 Bullet out any lessons learned, recommendations or other important "take away" information that would benefit others. Tie the recommendations to the incident or event, and avoid including information that is not directly tied to the event. 	
Submitted By	[Name/Office Location/Phone]	
Additional Information Contact	[Name/Office Location/Phone]	
Keywords/Categories	[Insert any keywords or incident categories that would aid in a search for this lessons learned]	

Send completed Lessons Learned to the ESBG HSSE Director for posting and distribution. Please include a recommended distribution list.

CH2M HILL Health and Safety Plan Attachment 6

Fact Sheets

Benzene Fact Sheet Tick Fact Sheet Vehicle Accident Guidance Working Alone





Tick-Borne Pathogens — A Fact Sheet

Most of us have heard of Lyme disease or Rocky Mountain Spotted Fever (RMSF), but there are actually six notifiable tick-borne pathogens that present a significant field hazard. In some areas, these account for more than half of our serious field incidents. The following procedures should be applied during any field activity—even in places that are predominantly paved with bordering vegetation.

Hazard Recognition

An important step in controlling tick related hazards is understanding how to identify ticks, their habitats, their geographical locations, and signs and symptoms of tick-borne illnesses.

Tick Identification

There are five varieties of hard-bodied ticks that have been associated with tick-borne pathogens. These include:

- Deer (Black Legged) Tick (eastern and pacific varieties)
- Lone Star Tick
- Dog Tick
- Rocky Mountain Wood Tick

These varieties and their geographical locations are illustrated on the following page.

Tick Habitat

In eastern states, ticks are associated with deciduous forest and habitat containing leaf litter. Leaf litter provides a moist cover from wind, snow, and other elements. In the north-central states, is generally found in heavily wooded areas often surrounded by broad tracts of land cleared for agriculture.

On the Pacific Coast, the bacteria are transmitted to humans by the western black-legged (deer) tick and habitats are more diverse. For this region, ticks have been found in habitats with forest, north coastal scrub, high brush, and open grasslands. Coastal tick populations thrive in areas of high rainfall, but ticks are also found at inland locations.

Illnesses and Signs & Symptoms

There are six notifiable tick-borne pathogens that cause human illness in the United States. These pathogens may be transmitted during a tick bite—normally hours after attachment. The illnesses, presented in approximate order of most common to least, include:

- Lyme (bacteria)
- RMSF (bacteria)
- Ehrlichiosis (bacteria)
- STARI (Southern Tick-Associated Rash Illness) (bacteria)
- Tularemia (Rabbit Fever) (bacteria)
- Babesia (protozoan parasite)

Symptoms will vary based on the illness, and may develop in infected individuals typically between 3 and 30 days after transmission. Some infected individuals will not become ill or may develop only mild symptoms. These illnesses present with some or all of the following signs & symptoms: fever, headache, muscle aches, stiff neck, joint aches, nausea, vomiting, abdominal pain, diarrhea, malaise, weakness, small solid, ring-like, or spotted rashes. The bite site may be red, swollen, or develop ulceration or lesions. For Lyme disease, the bite area will sometimes resemble a target pattern. A variety of long-term symptoms may result if the illness is left untreated, including debilitating effects and death.











From Left: adult female, adult male, nymph, and larvae Deer Tick (cm scale)



Lone Star Tick



Dog Tick



Rocky Mountain Wood Tick HSP ATTACHMENTS_DEPEW NY_JULY2015.DOC



Distribution of Deer Tick (dark green)



Distribution of Pacific Deer Tick (dark green)



Distribution of Lone Star Tick (Green)







Hazard Control

The methods for controlling exposure to ticks include, in order of most- to least-preferred:

- Avoiding tick habitats and ceasing operations in heavily infested areas
- Reducing tick abundance through habitat disruption or application of acracide
- Personal protection through use of repellants and protective clothing
- Frequent tick inspections and proper hygiene

Vaccinations are not available and preventative antibiotic treatment after a bite is generally not recommended.

Avoidance and Reduction of Ticks

To the extent practical, tick habitats should be avoided. In areas with significant tick infestation, consider stopping work and withdrawing from area until adequate tick population control can be achieved. Stopping and withdrawing should be considered as seriously as entering an area without proper energy control or with elevated airborne contaminants—tick-borne pathogens present risk of serious illness!

In areas where significant population density or infestation exists, tick reduction should be considered. Tick reduction can be achieved by disrupting tick habitats and/or direct population reduction through the use of tick-toxic pesticides (Damminix, Dursban, Sevin, etc.).

Habitat disruption may include only simple vegetative maintenance such as removing leaf litter and trimming grass and brush. Tick populations can be reduced by between 72 and 100 percent when leaf litter alone is removed. In more heavily infested areas, habitat disruption may include grubbing, tree trimming or removal, and pesticide application (Damminix, Dursban, Sevin, etc.). This approach is practical in smaller, localized areas or perimeter areas that require occasional access. Habitat controls are to be implemented with appropriate health and safety controls, in compliance with applicable environmental requirements, and may be best left to the property owner or tenant or to a licensed pesticide vendor. Caution should be exercised when using chemical repellents or pesticides in or around areas where environmental or industrial media samples will be collected for analysis.

Personal Protection

After other prevention and controls are implemented, personal protection is still necessary to control exposure to ticks. Personal protection must include all of the following steps:

- So that ticks may be easily seen, wear light-colored clothing. Full-body New Tyvek (paper-like disposable coveralls) may also be used
- To prevent ticks from getting underneath clothing tuck pant legs into socks or tape to boots
- Wear long-sleeved shirts, a hat, and high boots
- Apply DEET repellent to exposed skin or clothing per product label
- Apply permethrin repellent to the outside of boots and clothing before wearing, per product label
- Frequently check for ticks and remove from clothing
- At the end of the day, search your entire body for ticks (particularly groin, armpits, neck, and head) and shower





• To prevent pathogen transmission through mucous membranes or broken/cut skin, wash or disinfect hands and/or wear surgical-style nitrile gloves any time ticks are handled

Pregnant individuals and individuals using prescription medications should consult with their physician and/or pharmacists before using chemical repellents. Because human health effects may not be fully known, use of chemical repellents should be kept to a minimum frequency and quantity. Always follow manufacturers' use instructions and precautions. Wash hands after handling, applying, or removing protective gear and clothing. Avoid situations such as hand-to-face contact, eating, drinking, and smoking when applying or using repellents.

Remove and wash clothes per repellent product label. Chemical repellents should not be used on infants and children.

Vaccinations are generally not available for tick-borne pathogens. Although production of the LYMErix[™] Lyme disease vaccination has been ceased, vaccination may still be considered under specific circumstances and with concurrence from the consulting physician.

Tick Check

A tick check should be performed after field survey before entering the field vehicle (you do not want to infest your field vehicle with ticks). Have your field partner check your back; the backs of your legs, arms, and neck; and your hairline. Shake off clothing as thorough as possible before entering the vehicle. Once the field day is complete, repeat this procedure and perform a thorough self check.

If a tick has embedded itself into the skin, remove the tick as described below.

Tick Removal

1. Use the tick removal kit obtained through the CH2M HILL Milwaukee warehouse, or a fine-tipped tweezers or shield your fingers with a tissue, paper towel, or nitrile gloves.

Error! Objects cannot be created from editing field codes.

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 healthcare provider if infection occurs.





3. Avoid squeezing, crushing or puncturing the body of the tick because its fluids (saliva, hemolymph, gut contents) may contain infectious organisms. Releasing these organisms to the outside of the tick's body or into the bite area may increase the chance of infectious organism transmission.

4. Do not handle the tick with bare hands because infectious agents may enter through mucous membranes or breaks in the skin. This precaution is particularly directed to individuals who remove ticks from domestic animals with unprotected fingers. Children, elderly persons, and immunocompromised persons may be at greater risk of infection and should avoid this procedure.

5. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.

6. Should you wish to save the tick for identification, place it in a plastic bag, with the date of the tick bite, and place in your freezer. It may be used at a later date to assist a physician with making an accurate diagnosis (if you become ill).





Note: Folklore remedies such as 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, increasing the chances of transmitting the pathogen. These methods of tick removal should be avoided. In addition, a number of tick removal devices have been marketed, but none are better than a plain set of fine tipped tweezers.

First-Aid and Medical Treatment

Tick bites should always be treated with first-aid. Clean and wash hands and disinfect the bite site after removing embedded tick. Individuals previously infected with Lyme disease does not confer immunity—re-infection from future tick bites can occur even after a person has contracted a tick-borne disease.

The employee should contact the Injury Management/Return To Work provider (IMRTW), WorkCare using the toll-free number 866-893-2514 to report the tick bite. WorkCare will follow-up with each CH2M Hill employee who reports a tick bite and is at risk of developing Lyme disease by monitoring for symptoms up to 45 days, and will refer the employee to a medical provider for evaluation and treatment as necessary.





Vehicle Accident Guidance—E&NBG

Remember that if you a **renting** a non-CH2M HILL owned vehicle (short-term rental) in the U.S., you should carry the <u>insurance card</u> from the state where your driver's license is issued.

If you operate a **fleet vehicle**, carry the <u>insurance card</u> where the vehicle is registered.

For ALL Vehicles if you are in an accident:

1. If you are injured, call 911 for emergency medical treatment or 1-866-893-2514 to contact the CH2M HILL Occupational Nurse/Physician for minor injuries. If you feel you have not been injured, contact the RHSM for guidance on whether calling the CH2M HILL Occupation Nurse/Physician is applicable.

2. **Call the Police--**For any vehicle accident/damage, it is recommended that the local police (or site security/emergency services if working on a client site that provides such services) be called to determine if a report needs to be filed. In some instances, a report may not be required (during accident alerts, or in public parking lots). Document that the authorities were called and follow up with any guidance they give you. State requirements vary. If a report is filed, obtain a copy.

- 3. Notify Supervisor, (and PM/RHSM if working on a project site)
- 4. Complete a HITS report on the VO.

Additional Steps

To report an auto accident, and before a claim can be taken by telephonic reporting, have available your name (the company name alone is no longer accepted, a <u>driver's name must be provided even for fender benders</u>), location of accident and your office address if different than the accident location, business group and <u>project number</u>. <u>A claim cannot be taken without your name, address, business group and your project number</u>. By location the state where the accident occurred, and which office you are aligned to, i.e., accident occurs in Idaho, but you are out of the Denver office. Advise the claim recorder the accident occurred in ID, but that your office location is Denver. This will assist the claim intake person in identifying location coding for the claims.

Auto accidents involve two different sections of an Auto policy:

- 1) Liability to others due to Bodily Injury and Property Damage
- 2) Physical Damage Comprehensive and Collision damage to the vehicle CH employee is driving

CH2M Hill has Liability coverage for any auto - our policy will respond on either a primary or excess basis.

Refer to the table below for additional notifications to make based on the type of accident experienced and vehicle being used.

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long term lease - lower 48	CH2M Hill - Primary	Contact Broadspire (1-800-753-6737); Mary Ellegood-Oberts/DEN (720-286-2291); Linda George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long term lease - Alaska (North Slope)	CH2M Hill - Primary	Mary Ellegood-Oberts/DEN (720-286-2291)
Client vehicle driven by CH2M Hill employee	Client's auto policy unless client has made CH2M Hill responsible for vehicle	Contact Broadspire (1-800-753-6737); Mary Ellegood-Oberts/DEN (720-286-2291); contact client

Liability - Bodily Injury or Property Damage to Others





Short term lease (30 days or less)	Rental car company if rented through Enterprise, Budget or Hertz; CH2M Hill excess	Contact Broadspire (1-800-753-6737); Contact local branch of rental car company where vehicle leased (ERAC includes 24 hour roadside assistance) and Mary Ellegood-Oberts/DEN (720-286-2291)
Short term lease (30 days or less)	CH2M Hill - Primary if rented through company other than our national agreements; \$100,000 deductible	Contact Broadspire (1-800-753-6737); Contact rental car company and Mary Ellegood-Oberts/DEN (720-286-2291)
Personal vehicle used on business	Employee's personal auto policy; CH2M Hill on an excess basis	Contact personal auto insurance company; contact Mary Ellegood-Oberts/DEN (720-286-2291)

Physical Damage - damage to vehicle CH employee was driving

Scenario	Which Coverage Responds	What to do if in an accident
CH2M Hill fleet, pool or project vehicle - long	CH2M Hill ONLY if vehicle is	Contact Broadspire (1-800-753-6737);
term lease - lower 48	scheduled on policy - \$5,000	Mary Ellegood-Oberts/DEN (720-286-2291); Linda
	deductible	George/DEN (720-286-2057)
CH2M Hill fleet, pool or project vehicle - long	CH2M Hill Equipment Schedule if	Contact Mary Ellegood-Oberts/DEN (720-286-2291)
term lease - Alaska (North Slope)	scheduled on policy	
CH2M Hill fleet, pool or project vehicle - long	ARI if physical damage coverage	Contact Mary Ellegood-Oberts/DEN (720-286-2291);
term lease	purchased - \$500 deductible	call ARI at 1-800-221-1645 give them Client Code
		and ARI fleet vehicle number; and notify Linda
		George/DEN - Fleet Coordinator - 720-286-2057
Client vehicle CH2M Hill Employee is driving	Client's auto policy unless client	Contact Mary Ellegood-Oberts/DEN (720-286-2291);
	has made CH2M Hill contractually	contact client;
	responsible for vehicle	contact Broadspire (1-800-753-6737)
Short term lease (30 days or less) using	VISA if corporate credit card used	Contact VISA - 1-800-847-2911 or
corporate VISA	and vehicle is not a pickup, truck,	http://www.visa.com/eclaim
	cargo van or used off-road	
Short term lease (30 days or less) through	ERAC up to \$3,000 in damage;	Notify Rental Car Company;
Enterprise (ERAC) and vehicle is used off-	CH2M Hill's coverage is excess	contact Mary Ellegood-Oberts/DEN (720-286-2291)
road and physical damage coverage included		if damage over \$5,000
when vehicle leased		
Short term lease (30 days or less) did not use	CH2M Hill - \$5,000 deductible	Contact Broadspire (1-800-753-6737); Contact Mary
corporate VISA	(project responsibility)	Ellegood-Oberts/DEN (720-286-2291); contact VISA -
		1-800-847-2911 or http://www.visa.com/eclaim
Personal vehicle used on business	CH will reimburse the amount of	Contact Mary Ellegood-Oberts/DEN (720-286-2291);
	the deductible carried on the	contact client; contact Broadspire (1-800-753-6737)
	employee's policy up to \$500	
	whichever is less	

Details for reporting a claim on the CH2M Hill VO are accessed by going to the VO home page and clicking:

GLOBAL ENTERPRISE SERVICES/INSURANCE & BONDING/CLAIMS REPORTING

HOW DO I REPORT A CLAIM TAB or access the following URL:

https://www.int.ch2m.com/intrnl/voffice/corp/insurance/claims/report.asp?Menu=menu3h







For Personally Owned Vehicles (POVs):

CH2M HILL does not provide auto insurance for POVs, it is responsibility of the owner. If you are in a vehicle accident conducting company business, contact the police as above, supervisor, and 911 or CH2M HILL's occupational nurse/physician as stated above. Complete a HITS report. Contact Julie Zimmerman/DEN for assistance for meeting personal insurance deductibles (up to \$500) with proof of insurance and deductible.

If using your POV for extended project use, notify the PM to make sure a rental car is not needed. Check your insurance policy for guidance on using the POV for business use.

Additional Resources:

Claims Resource Manual

WORKING ALONE PROTOCOL CALL - IN CONTACT FORM

Expected start time:
-
eive contact:

Planned Activity:_______Specified Frequency and time for call in:______

Time	Verified	

If lone worker fails to call in at specified frequency/time:

- 1) Call worker's radio and cell to determine if an emergency exists.
- 2) If no reply, immediately call Client security/emergency service if there is one at the site.

Location

- 3) If there is no client security call Emergency Services (911). Inform the dispatcher there is a lone worker that cannot be contacted and there may be an emergency on site. Provide the lone worker's name, their last known location, and your contact information.
- 4) After Emergency Services have been contacted, call the other emergency contacts, Project Manager, and Responsible Health and Safety Manager.

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 7

Observed Hazard Form

CH2MHILL

OBSERVED HAZARD FORM

Name/Company of Observer (optional):	
Date reported:	Time reported:
Contractor/s performing unsafe act or cre 1	eating unsafe condition:
2	
3	
Location of Unsafe Act or Condition:	
Name of CH2M HILL Representative:	
Corrective Actions Taken:	Date:
Project Safety Committee Evaluation:	Date:

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 8

Stop Work Order Form

CH2MHILL

Stop Work Order

REPORT PREPARED BY:

Name:	Title:	Signature:	Date:

ISSUE OF NONPERFORMANCE:

Description:	Date of
	Nonperformance:

SUBCONTRACTOR SIGNATURE OF NOTIFICATION:

Name:	Title:	Signature:	Date:

* Corrective action is to be taken immediately. Note below the action taken, sign and return to CCI.* Work may not resume until authorization is granted by CH2M HILL Constructors, Inc. Representative,

SUBCONTRACTOR'S CORRECTIVE ACTION

Description:	Date of
	Nonperformance:

SUBCONTRACTOR SIGNATURE OF CORRECTION

Name:	Title:	Signature:	Date:

CH2M HILL HEALTH AND SAFETY PLAN

Attachment 9

Agency Inspection Target Zero Bulletin

Environmental Services Business Group

TARGET ZERO BULLETIN

Subject: HSSE Agency Inspections (OSHA, EPA, DOT, State Health Department)

Do you know what YOU would do if an agency inspector arrived at your site unannounced? Recently, a State Occupational Safety and Health Administration (OSHA) inspector made an unannounced visit to one of our Federal project sites. OSHA, U.S. Environmental Protection Agency (EPA), and authorized state or local agencies have authority to inspect any facility that is subject to health, safety, and environmental legislation. Inspections may be announced or unannounced. This particular inspector indicated that the project was targeted for an inspection because the work was funded by the American Recovery and Reinvestment Act (ARRA).

Enterprise Standard Operating Procedure (SOP) HSE-201, *Agency Inspections and Communications,* describes the responsibilities, procedures, and requirements associated with inspections conducted by external regulatory agencies, as well as the methods for communicating information to key individuals. This Target Zero Bulletin is a brief summary of what to do in the event of an agency inspection at your site. Refer to the SOP for more specific guidance.

Notification of Inspections

- If the inspection is an <u>announced</u> regulatory agency inspection, the Project Manager (PM) should notify the Responsible Health and Safety Manager (RHSM) and Responsible Environmental Manager (REM) well in advance of the inspection.
- If an <u>unannounced</u> agency inspector visits one of our projects, Field personnel must immediately notify the project Emergency Response Coordinator (ERC). Typically the ERC is the Safety Coordinator (SC).
- The ERC must immediately notify the RHSM/REM, as appropriate, of unannounced inspections, or designate someone to call the RHSM/REM. The RHSM/REMs can provide guidance to the field staff and PM.

Inspector Credential Verification

- Upon arrival, the ERC must request the inspector to provide official credentials. Record the inspector's name and office phone number or obtain the inspector's business card.
- The inspector shall sign the visitors log and be given a site-specific health, safety, and environmental protection briefing.
- The inspector shall meet any site access requirements associated with security clearances, specialized training, and medical monitoring. The CH2M HILL representative shall verify that the inspector possesses these requirements; access will only be granted to those areas where appropriate access requirements are met. Some inspectors have the authority to gain access to any work area at any time, such as an inspector with a search warrant. In these cases, we can stop work operations as necessary to protect the safety of the inspector(s).

Opening Conference

- The CH2M HILL Project Manager, ERC, RHSM, or REM, and the inspector shall determine attendees for the opening conference. The RHSM (for OSHA and other worker health and safety inspections) or REM (for environmental inspections) shall join the opening conference via conference call.
- The inspector shall inform CH2M HILL of the purpose of the inspection and provide a copy of the complaint, if applicable.
- The inspector shall outline the scope of the inspection, including employee interviews conducted in private, physical inspection of the workplace and records, possible referrals, discrimination complaints, and the closing conference(s).

Requests for OSHA Logs

 An OSHA inspector may request to review the project OSHA Injury/Illness log, better known as the OSHA 300 Log. Contact your RHSM for assistance in obtaining the OSHA 300 Log.

- Field projects with a continuous duration of one year or longer are considered to be separate establishments and are required to maintain an OSHA 300 log specific to the project. The project OSHA 300 log should be maintained onsite and kept current.
- Recordable injuries and illnesses sustained on field projects less than one year in duration are maintained on the CH2M HILL office log where the injured employee is based.

The Inspection

- The scope of the inspection shall be limited to that indicated by the inspector in the opening conference. The
 inspector shall be escorted to relevant areas only. The ERC or other designated by the RHSM or REM must
 accompany the inspector during the inspection.
- Ensure that the inspection is limited to the scope that the inspector disclosed during the opening conference. The ERC should always take notes which identify: areas inspected, machinery or equipment and materials examined, employees or other persons interviewed, and photographs taken by the inspector.
- The inspector will observe safety, health, and environmental conditions and practices and document the inspection process. The inspector may also take photos and instrument readings, examine records, collect air samples, measure noise levels, survey existing engineering controls, and monitor employee exposure to toxic vapors, gases, and dusts.
- CH2M HILL should gather duplicate information (photographs, readings, samples) in the same manner and condition as the inspector. If the equipment needed to take duplicate samples is not onsite, ask the inspector if the sampling can wait until the equipment is available. If samples are taken, request a description of the tests that the agency intends to perform on the samples and request results as soon as they are available.
- Employees may be questioned during the inspection tour. The employee can refuse to speak to an inspector, can speak to the inspector with a company representative (including management) present, or can speak to the inspector privately. It is CH2M HILL policy that employees who wish to speak to the inspector are not discriminated against, intimidated, or otherwise mistreated for exercising their rights during compliance inspections.
- Copies of documents should not be provided to the inspector without the approval of the RHSM or REM or Legal Insurance Department (LID). **DO NOT** voluntarily release documents. Respond only to inspection team requests.
- During the course of the inspection, the inspector may point out violations. For each violation, the CH2M HILL
 representative should ask the inspector to discuss possible corrective action. Where possible, violations
 detected by the inspector should be corrected immediately and noted by the inspector as corrected.
- For those items which cannot be corrected immediately, an action plan shall be formulated for timely correction. In any instance, employees exposed to hazards shall be removed from the area.

Closing Conference

After the inspection, a closing conference is normally held as follows:

- The CH2M HILL PM, ERC, RHSM or REM shall be involved via conference call in the closing conference, at a minimum;
- The inspector shall describe the apparent violations found during the inspection and other pertinent issues as deemed necessary by the inspector. CH2M HILL shall be advised of their rights to participate in any subsequent conferences, meetings or discussions. Any unusual circumstances noted during the closing conference shall be documented by the ERC;
- The inspector shall discuss violations observed during the inspection and indicate for which violations a citation and a proposed penalty may be issued or recommended;
- The ERC shall request receipts for all samples and approved documents photocopied by the inspector, request a photocopy of the inspector's photograph log, and request a copy of the final inspection report; and
- Any documentation from an agency inspection must be transmitted immediately to the RHSM or REM, and LID.

Unannounced regulatory agency inspections may happen at any time on our projects -

Get your RHSM/REM and PM involved immediately if an Inspector arrives.

CH2M HILL HEALTH AND SAFETY PLAN Attachment 10

Completed CH2M HILL AHAs

CH2M HILL HEALTH AND SAFETY PLAN Attachment 11

Material Safety Data Sheets

Appendix C ISTT Soil Sampling Methodology

SOIL CORE CHARACTERIZATION STRATEGY AT DNAPL SITES SUBJECTED TO STRONG THERMAL OR CHEMICAL REMEDIATION

Megan Gaberell, Arun Gavaskar, Eric Drescher, Joel Sminchak, Lydia Cumming, Woong-Sang Yoon, and Sumedha De Silva (Battelle, Columbus, Ohio, USA)

ABSTRACT: At Launch Complex 34 (LC34), Cape Canaveral Air Station, Florida, high concentrations of trichloroethylene (TCE) exist in groundwater and free phase (DNAPL) has been detected in the subsurface. Characterizing or monitoring sites that are contaminated with volatile organic compounds (VOCs) such as TCE is often challenging because of the difficulties associated in minimizing VOC loss during soil sample handling and collection. New difficulties in post-demonstration soil sampling were encountered due to (1) the residual strong oxidant remaining in the soil cores of the oxidation remediation plot; and (2) the high temperatures (50-95°C) in the thermal remediation plot that persisted for several months after the remediation had been completed. To evaluate the efficiency of the soil collection and sampling method in recovering VOCs, hot soil cores were brought to the surface and spiked with a surrogate compound, 1,1,1-trichloroethane (1,1,1-TCA). The results show that between 84 and 113% of TCA in the soil was recovered using field procedures designed to minimize VOC loss while protecting personnel handling the hot soil cores. The results also indicate that any VOC loss occurring during cooling of the soil core is minimal and within the acceptable limitations of the field sampling protocol.

INTRODUCTION

Dense nonaqueous-phase liquid (DNAPL) contamination presents a persistent environmental problem at many federal and private facilities. At Launch Complex 34 (LC 34), Cape Canaveral Air Station, Florida, high concentrations of trichloroethylene (TCE) exist in groundwater and free phase (DNAPL) has been detected in the subsurface. The Interagency DNAPL Consortium (IDC), a consortium consisting of U.S. Department of Energy (DOE), U.S. Department of Defense (DoD), U.S. Environmental Protection Agency (EPA), and the National Aeronautic and Space Administration (NASA), has been assessing several innovative DNAPL remediation technologies, including those that use thermal or chemical oxidation treatment. Post-demonstration characterization was conducted to verify the effectiveness of these innovative technologies, which were demonstrated in separate test plots in the DNAPL source zone.

Characterizing or monitoring sites that are contaminated with volatile organic compounds (VOCs) such as TCE is often challenging because of the difficulties associated in minimizing VOC loss during soil sample handling and collection. At LC 34, new difficulties in post-demonstration soil sampling were encountered due to (1) the residual strong oxidant remaining in soil cores of the chemical oxidation remediation plot; and (2) the high temperatures (50-95°C) in the thermal remediation plots that persisted for several months after the remediation had been completed. Field procedures for soil core handling and sampling were designed to take into account the safety issues posed by the strong oxidant (potassium permanganate) used at LC34 in the chemical

oxidation plot (Battelle, 1999). Field procedures for collecting soil cores and soil samples from the thermal remediation plot were modified in an effort to minimize VOC losses that can occur as a result of contaminant volatilization associated with elevated soil temperature (Battelle, 2001). Because additional consideration must be given to issues such as personnel safety when handling hot soil cores, there is the possibility that increased handling times during soil coring and sample collection may result in an increase in VOC losses. An experiment was conducted using soil samples spiked with a surrogate compound to investigate the effectiveness of the field procedures developed for LC34 in minimizing VOC losses. Because the soil sampling procedures were similar for both the chemical oxidation and thermal remediation strategies, the remainder of this paper focuses on issues associated with the collection and sampling of soil at elevated temperatures.

MATERIALS AND METHODS

Soil cores were collected in a 2-inch diameter, 4-foot long acetate sleeve that was placed tightly inside a 2-inch diameter stainless steel core barrel. The acetate sleeve was immediately capped on both ends with a protective polymer covering. The sleeve was placed in an ice bath to cool the heated core to below ambient groundwater temperatures (approximately 20°C). The temperature of the soil core was monitored during the cooling process with a meat thermometer that was pushed into one end cap (see Figure 1). Approximately 30 minutes was required to cool each 4-foot long, 2-inch diameter soil core from 50-95°C to below 20°C. Upon reaching ambient temperature, the core sleeve was then uncapped and cut open along its length to collect the soil sample for contaminant analysis (see Figure 2).

Soil samples were collected in relatively large quantities (approximately 200 g) along the entire length of the core rather than sampling small aliquots of the soil within



FIGURE 1. A soil core capped and cooling in an ice bath. The thermometer is visible in the end cap.



FIGURE 2. A soil sample being collected from along the length of the core into a bottle containing methanol.

the core, as required by the conventional method (EPA SW5035). This modification is advantageous because the resultant data provide an understanding of the continuous VOC distribution with depth. VOC losses during sampling were further minimized by placing the recovered soil samples directly into bottles containing methanol (approximately 250 mL) and extracting them on site. The extracted methanol was centrifuged and sent to an off-site laboratory for VOC analysis. Soil samples taken from the chemical oxidation plot were handled similarly, although they did not require cooling. The soil sampling and extraction strategy is described in more detail in Gavaskar et al. (2000).

To evaluate the efficiency of the sampling method in recovering VOCs, hot soil cores were extracted from 14 through 24 feet below ground surface and spiked with a surrogate compound, 1,1,1-trichloroethane (1,1,1-TCA). The surrogate was added to the intact soil core by using a 6" needle to inject 25 μ L of surrogate into each end of the core for a total of 50 μ L of 1,1,1-TCA. In order to evaluate the effect of the cooling period on VOC loss, three soil cores were spiked with TCA prior to cooling in the ice bath and three cores were spiked with TCA after cooling in the ice bath. In the pre-cooling test, the surrogate was injected as described above and the core barrels were subsequently capped and placed in the ice bath for the 30 minutes of cooling time required to bring the soil core to below 20°C. A thermometer was inserted through the cap to monitor the temperature of the soil core.

In the post-cooling test, the soil cores were injected with TCA after the soil core had been cooled in the ice bath to below 20° C. After cooling, the caps on the core barrel were removed and the surrogate compound was injected in the same manner, 25μ L per each end of the core barrel using a 6" syringe. The core was recapped and allowed to equilibrate for a few minutes before it was opened and samples were collected. Only for the purpose of the surrogate recovery tests, the entire contents of the sampling sleeve were collected and extracted on site with methanol. The soil: methanol ratio was kept approximately the same as during the regular soil sample collection and extraction. Several (four) aliquots of soil and several (four) bottles of methanol were required to extract the entire contents of the sample sleeve.

Two different capping methods were used during this experiment to evaluate the effectiveness of each cap type. Two of the soil cores were capped using flexible polymer sheets attached to the sleeve with rubber bands. The remaining four soil cores were capped with tight-fitting rigid polymer end caps. One reason that the polymer sheets were preferred over the rigid caps was that the flexible sheets were better positioned to handle any contraction of the sleeve during cooling.

RESULTS AND DISCUSSION

The results from the surrogate spiking experiment are shown in Table 1. Soil cores 1, 3, and 5 received the surrogate spike prior to cooling in the ice bath. Soil cores 2, 4, and 6 received the surrogate spike after cooling in the ice bath. The results show that between 84 and 113% of the surrogate spike was recovered from the soil cores. Recovery comparison is not expected to be influenced significantly by soil type because all samples were collected from a fine grained to medium fine-grained sand unit. The results also indicate that the timing of the surrogate spike (i.e., pre- or post-cooling) appeared to have only a slight effect on the amount of surrogate recovered. Slightly less surrogate was recovered from the soil cores spiked prior to cooling. This implies that any

losses of TCA in the soil samples spiked prior to cooling are minimal and acceptable, within the limitations of the field sampling protocol. The field sampling protocol was designed to process up to 300 soil samples that were collected over a 3-week period, during each monitoring event.

Soil Cores	Capping	1,1,1-TCA	Soil Cores	Capping	1,1,1-TCA
Spiked Prior	Method	Recovery	Spiked After	Method	Recovery
to Cooling		(%)	Cooling		(%)
Core 1	Flexible	96.3	Core 2	Flexible	98.7
	polymer			polymer	
	sheet with			sheet with	
	rubber bands			rubber bands	
Core 3	Rigid End	101.0	Core 4	Rigid End	112.6
	Cap			Cap	
Core 5	Rigid End	84.3	Core 6	Rigid End	109.6
	Cap			Cap	

 TABLE 1. Recovery in soil cores spiked with 1,1,1-TCA surrogate

The capping method (flexible versus rigid cap) did not show any clear differences in the surrogate recoveries. The flexible sheets are easier to use and appear to be sufficient to ensure good target compound recovery.

This experiment demonstrates that the soil core handling procedures developed for use at LC34 were successful in minimizing volatility losses associated with the extreme temperatures of the soil cores. It also shows that collecting and extracting larger aliquots of soil in the field is a good way of characterizing DNAPL source zones.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the IDC members, and Tom Holdsworth (EPA) and Jackie Quinn (NASA) in particular, for their support during the site characterization and performance assessment at LC34. DHL Analytical provided analytical support during this demonstration.

REFERENCES

- Battelle, 1999. Quality Assurance Project Plan for Performance Evaluation of In-Situ Oxidation for DNAPL Destruction at Launch Complex 34, Cape Canaveral, Florida. Prepared by Battelle for the Air Force Research Laboratory, Tyndall AFB, FL. September, 1999.
- Battelle, 2001. Quality Assurance Project Plan for Performance Evaluation of In-Situ Thermal Remediation System for DNAPL Removal at Launch Complex 34, Cape Canaveral, Florida. Prepared by Battelle for Naval Facilities Engineering Service Center, June, 2001.
- Gavaskar, A., S. Rosansky, S. Naber, N. Gupta, B. Sass, J. Sminchak, P. DeVane, and T. Holdsworth. 2000. "DNAPL Delineation with Soil and Groundwater Sampling." Proceedings of the Second International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Monterey, California, May 22-25. Battelle Press. 2(2): 49-58.



Sampling of Hot Soil

Mark Bowen Project Engineer Anderson Mulholland & Associates

Greg Beyke, PE VP - Engineering Thermal Remediation Services



Hot Soil Sample Procedure

- The soil core barrel can be collected by any method, although direct push technology (DPT, GeoProbe[™]) is preferred.
- A temperature-resistant core barrel is required, Teflon[™], stainless steel, or brass.
- standard work gloves or heavy-duty rubber gloves provide protection to handle the collected cores



Hot Soil Sample Procedure

- The recovered core barrel is immediately capped and placed on ice for cooling
- Typical cooling time for a 2" core barrel is 5-10 minutes for a metal barrel, 10-20 minutes for a Teflon barrel.

Meat thermometer





Hot Soil Sample Procedure

- When the core barrel is cool (<20°C), the core barrel is opened and an analysis subsample is collected from near the centerline of the core barrel.
- the sample will be screened at surface with a PID and the soil sample will be collected from the six inch interval registering the highest value on the PID in accordance with 6.2.7.1 of the NJDEP *Field Sampling Procedures Manual*





What if the Hot Soil Sample Procedure is not followed?

- The heat capacity of moist soil is about 0.3 BTU/lb°F.
- In cooling from 212°F to 60°F, about 45 BTU/lb are available for evaporation of water and VOCs.
- 45 BTU can evaporate 0.045 lb of water or 4.5% of the mass of the sample.
- During the ERH remediation, we plan to evaporate about 18% of the total mass of the site, four times greater than the most that could be evaporated under "worst practices" soil sampling.



Lawrence Livermore National Laboratory Study - 1993

- An innovative soil sample analysis technique called Bulk Thermal Desorption (BTD) was tested.
- To evaluate BTD, LLNL spiked hot soil samples with TCE and chlorobenzene.
- A total of 17 hot soil sample cores were spiked and the average spike recovery was 89% - this is generally considered to be good recovery.
- LLNL attributed the minor discrepancy to the spiking procedure, not hot soil sampling.



Battelle - Interagency DNAPL Consortium Study - 2001

- Specifically designed to test the Hot Soil Sample procedure.
- Funded and reviewed by DOE, DoD, NASA, and US EPA.
- Battelle spiked hot soil samples with 1,1,1-TCA.
- Three hot soil sample cores were spiked and the average spike recovery was 94%.

Appendix D Environmental Management Plan

Environmental Management Plan In Situ Thermal Treatment Former Dowell Depew Facility Depew, New York

Prepared for

Schlumberger Technology Corporation and the Dow Chemical Company

August 2015



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ENVIRONMENTAL MANAGEMENT PLAN: IN SITU THERMAL TREATMENT, FORMER DOWELL DEPEW FACILITY, DEPEW, NEW YORK

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Acronyms and Abbreviations

CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DAR	Division of Air Resources
EM	environmental manager
ERH	electrical resistance heating
ID	identification
ISTT	in situ thermal treatment
L	liter
LGAC	liquid-phase activated carbon
NYSDEC	New York State Department of Environmental Conservation
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
RQ	reportable quantity
site	Former Dowell Schlumberger Facility in Alice, Texas
SPCC	Spill Prevention, Countermeasure, and Control
STC	Schlumberger Technology Corporation
TCLP	toxicity characteristic leaching procedure
UIC	Underground Injection Control
USEPA	U.S. Environmental Protection Agency
VGAC	vapor phase granular activated carbon

Introduction

This environmental management plan contains general procedures that will be implemented to maintain compliance, fulfill permitting requirements, prevent pollution, and protect existing environmental resources during in situ thermal treatment (ISTT) activities that are designed to address volatile organic compound (VOC) concentrations in onsite groundwater that are above applicable standards, criteria, and guidelines values at the at the former Dowell Depew Facility (site) located at 3311 Walden Avenue in the Village of Depew, New York.

The plan is intended to be used in conjunction with the following documents and plans:

- Remedial action work plan (RAWP)
- Site-specific health and safety plan

1.1 Key Work Elements

The following are the key work elements:

- Drilling to install the heater borings and/or electrodes, vapor recovery wells, and temperature monitoring points
- Overdrilling/abandonment of existing monitoring and injection wells
- Groundwater and soil sampling
- Power connection (subcontractor)
- Fluid (vapor or liquid) recovery system construction
- Vapor cap installation (commonly a spray-on concrete material)
- Waste management that may include the following: soil from drill cuttings, well abandonment debris, decontamination water, personal protective equipment [PPE], waste from system operation, spent vapor- or liquid-phase activated carbon [VGAC or LGAC]) and general waste.

1.2 Regulatory Requirements Considered

The following were evaluated with respect to the key work elements to determine the potentially applicability of regulatory requirements, including the following:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) reportable quantities (RQs)—not applicable since bulk chemicals are not expected to be stored onsite.
- Emergency Preparedness and Community Right-to-Know Act RQ—not applicable since bulk chemicals are not expected to be stored onsite.
- Tier II RQ for New York and the U.S. Environmental Protection Agency (USEPA)—not applicable since bulk chemicals are not expected to be stored onsite.
- Toxic Release Inventory reporting threshold—not applicable since bulk chemicals are not expected to be stored onsite.
- Department of Homeland Security chemical of interest screening thresholds—not applicable since bulk chemicals are not expected to be stored onsite.
- Clean Water Act requirements—potentially applicable.
- Clean Air Act (CAA)—potentially applicable.

ENVIRONMENTAL MANAGEMENT PLAN: IN SITU THERMAL TREATMENT, FORMER DOWELL DEPEW FACILITY, DEPEW, NEW YORK

• International Fire Code 2012 permitting requirements—not applicable since bulk chemicals are not expected to be stored onsite; small quantities of fuel (5 to 10 gallons) may be kept onsite in approved portable containers.

Those regulations that are, or are potentially, applicable are described in more detail in the following sections.

1.3 Applicable Regulations

1.3.1 Clean Water Act

1.3.1.1 Spill Prevention, Countermeasure, and Control Planning (40 *Code of Federal Regulations* 112)— Not Applicable

A facility is covered by the Spill Prevention, Countermeasure, and Control (SPCC) rule if it has an aggregate aboveground oil storage capacity greater than 1,320 gallons.

During remediation activities, small amount of fuel (that is, 5 to 10 gallons) may be kept onsite in approved containers; however, the aboveground oil storage capacity will not exceed 1,320 gallons, and therefore, an SPCC plan is not required.

1.3.1.2 Spill Reporting—Potentially Applicable

The Clean Water Act (40 *Code of Federal Regulations* [CFR] 117.21) requires immediate reporting of discharges of hazardous substances in quantities equal to or above the RQ. This requirement is made at the same RQ threshold as that in the CERCLA spill reporting requirements of 40 CFR 302.6(a). Clean Water Act (40 CFR 110) requires that an oil spill that could cause a film, sheen, or spill upon water, or sheen or sludge on adjoining shorelines must be reported to the National Response Center and the state water quality reporting agency. See reporting agencies for CERCLA spills in Section 10.

In addition, NYSDEC requires reporting of all spills regardless of quantity, except for petroleum spills that have a 5-gallon threshold.

Based on the U.S. Fish and Wildlife Service National Wetlands Inventory online mapping tool, a freshwater forested/shrub wetlands area is present immediately adjacent to the site on the south. In addition, an unnamed drainageway is located approximately 0.25-mile to the north, and Cayuga Creek is located approximately 1 mile to the southeast at its closest.

1.3.1.3 Water Discharge Permits—Portions Applicable

Since ISTT-produced water will not be discharged to a surface water, the National Pollutant Discharge Elimination System (NPDES) federal and state regulations (40 CFR 122 and 6 New York Codes, Rules and Regulations [NYCRR] PART 750) do not directly apply.

Condensation from the ISTT treatment system components will be collected, treated as necessary, and discharged to the publicly owned treatment works (POTW) under a discharge agreement. CH2M HILL (CH2M) will obtain written authorization from the City of Depew to discharge to the POTW prior to implementation. Requirements for treatment and monitoring, if necessary, will be indicated by the POTW in accordance with the discharge permit held by that entity that complies with NPDES regulations (40 CFR 122) and the General Pretreatment Regulations (40 CFR 103).

1.3.1.4 Underground Injection Control (40 CFR 144 and 146)—Applicable

A permit is required to inject substances into the subsurface. If electrical resistance heating (ERH) is selected as the most appropriate ISTT technology, a small volume of water would be added during the heating phase to keep the soil immediately adjacent to the electrodes moist and electrically conductive. The injection of clean water would classify the wells as Class V injection wells, and the activity would be permitted-by-rule. Notification is required to the USEPA Region 2 Underground Injection Control (UIC) Program providing site and activity information. USEPA Region 2 UIC program supervisor, Mr. Robert Ferri, has indicated that a form can be submitted or information can be sent directly to him by e-mail.

1.3.2 Clean Air Act

1.3.2.1 Chemical Accident Prevention Program—Not Applicable

If the quantity of a chemical onsite exceeds the CAA Chemical Accident Prevention Program threshold, a risk management program is required with associated worst-case scenario evaluations and submittals to emergency management officials.

Bulk chemicals will not be kept at the site; this requirement is not applicable.

1.3.2.2 Air Permitting (Federal and State)—Potentially Applicable

Air permitting requirements can be very complex. Air permits are required at a federal level when air emission source emit pollution at a "major source" threshold. The default threshold value is 100 tons per year for criteria pollutants, but could be lower in certain areas and/or for certain pollutants. Major source thresholds for hazardous air pollutants (HAP) are 10 tons per year for a single HAP or 25 tons per year for any combination of HAP. These are called Title V or Part 70 permits. Many states, including New York, are authorized by USEPA to implement the major source air permitting program. New York also issues permits to minor sources. Thresholds for these minor source air permits are 2.5 tons per year of any single HAP, 5 tons per year of total HAPs, 1,000 pounds per year of tetrachloroethene or trichloroethene, and 25 tons per year of total VOCs.

Based on preliminary estimates of contaminant mass in the target treatment zone, it is not anticipated that an air permit will be required from NYSDEC Division of Air Resources (NYSDEC DAR). The contaminant mass in the target treatment zone is estimated to be 100 pounds. Therefore, it is anticipated that the ISTT system will need to be registered with NYSDEC DAR, but not permitted.

1.4 Summary of Required Permits/Plans/Submittals

The following are key requirements based on the anticipated activities:

- A POTW agreement will be required due to the discharge of ISTT equipment condensate to the sanitary sewer system.
- If ERH is the selected ISTT, a UIC permit would be required by USEPA Region 2 to allow the addition of
 water to keep the soil moist and conductive. The activity is permitted by rule, but requires a notification
 of site and activity information to the agency.

Waste Management

The following subsections detail procedures that will be followed for waste management.

2.1 Waste Streams

It is anticipated that waste streams will be generated and managed as indicated in Table 2-1. Consult the project environmental manager (EM) and waste coordinator for waste streams generated or anticipated to be generated that are not identified in Table 2-1.

Table 2-1. Waste Management

Environmental Management Plan

Former Dowell Depew Facility, Depew, New York

Waste Stream	Source/Process	Staged In	Staged At	Final Disposition			
Soil	Drilling/soil sampling	55-gallon steel drums (in accordance with 49 CFR 173.213; for example, Steel drum 1A1 or IA2)	Secure onsite location	Offsite disposal			
Groundwater	Well purging/sampling	55-gallon steel drums (in accordance with 49 CFR 173.203; for example, Steel drum 1A1 or IA2)	Secure onsite location	Offsite disposal			
Accumulated rainwater/liquid in secondary containment	Precipitation or Secondary containment releases	55-gallon drums (in accordance with 49 CFR 173.203; for example, Steel drum 1A1 or IA2)	Secure onsite location	Rainwater must be inspected and can be pumped to the ground if the liquid in the containment appears to be only rainwater and appears clean. If releases occur and/or if accumulated rainwater appears contaminated, this will require offsite disposal.			
Contaminated debris, including PPE, plastic sheeting, disposable sampling equipment, well abandonment debris	Sampling, well abandonment and remedial efforts involving disposable equipment/supplies	55-gallon steel drums or may be placed with soil waste (in accordance with 49 CFR 173.213; for example, Steel drum 1A1 or IA2)	Secure onsite location	Offsite disposal.			
Contaminated liquids	Recovered from hydraulic extraction system, condensation of extracted vapors	55-gallon steel drums (in accordance with 49 CFR 173.203; for example, Steel drum 1A1 or IA2)	Secure onsite location	Treated onsite and discharged to local POTW or offsite disposal			
VGAC or LGAC	Treatment of liquids generated from hydraulic extraction system, condensation of extracted vapors	55-gallon steel drums (in accordance with 49 CFR 173.203 and/or 173.213; for example, Steel drum 1A1 or IA2)	Secure onsite location	Offsite Regeneration or disposal			
Decontamination water	Decontamination of equipment, etc. after fieldwork conclusion	55-gallon steel drums (in accordance with 49 CFR 173.203; for example, Steel drum 1A1 or IA2)	Secure onsite location	Offsite disposal.			

ENVIRONMENTAL MANAGEMENT PLAN: IN SITU THERMAL TREATMENT, FORMER DOWELL DEPEW FACILITY, DEPEW, NEW YORK

2.2 Waste Characterization

In general, wastes generated during the course of the project will be assessed for proper handling and final disposition through sampling and laboratory analyses. The exceptions are uncontaminated wastes (that is, no contact with contaminated media) and regular trash. This waste will be disposed of utilizing generator knowledge.

Contaminated liquid wastes will be analyzed for the following:

- VOCs (grab sample)
- Semivolatile organic compounds (composite sample)
- 8 Resource Conservation and Recovery Act (RCRA) metals (composite sample)
- Corrosivity (composite sample)
- Ignitability (composite sample)

Contaminated soil and granular activated carbon will be analyzed using the toxicity characteristic leaching procedure (TCLP) method for the following:

- TCLP VOCs (grab sample)
- TCLP semivolatile organic compounds (composite sample)
- TCLP metals (composite sample)
- Corrosivity (composite sample)
- Ignitability (composite sample)

These results will be compared to the criteria in 40 CFR Part 261 Subpart C and Title 6 Department of Environmental Conservation, Chapter IV Quality Services, Subchapter B, Part 371 (6 NYCRR Part 371) to determine waste classification as hazardous or nonhazardous.

PPE will be disposed with the soil or if containerized separately, using the soil analytical results. Samples will be collected in accordance with the general procedures below and sent to a client contracted laboratory for analyses.

One composite sample (and one grab for volatile organic compound analysis) will be collected per up to 10 drums of each waste stream. If larger containers are used, the waste manager will determine the frequency of sampling based on the quantity and container size.

2.3 Waste Classification

CH2M will take measures to minimize the amount of waste generated; however, the nature of remediation activities will result in the generation of wastes. Waste determinations will be made using process knowledge and/or laboratory analyses. The disposal facility may require additional laboratory analyses. Generally, debris will be classified using generator knowledge.

Wastes will be classified per Title 40 CFR Part 261 Subpart C and 6 NYCRR Part 371. A waste would be hazardous based on its characteristics per 40 CFR Part 261 Subpart C and 6 NYCRR Part 371 if it exhibits one or more hazardous characteristics. Characteristic hazardous waste will be identified with the "DXXX" waste code. Waste not exceeding these criteria will be classified as nonhazardous waste.

2.3.1 Land Disposal Restrictions (Hazardous Waste)

If a waste is determined to be hazardous, the applicable RCRA land disposal restriction standards for that waste will be identified. In general, hazardous wastes that will be land disposed of must meet certain treatment standards (either a specified technology or a specified concentration). If applicable, land disposal restriction documents will be prepared and submitted with the profile or with the first load of waste delivered to the facility.

2.4 Waste Profile

Waste characterization information will be documented on a waste profile form provided by the waste disposal facility. The profile will be reviewed and approved by the project waste coordinator. In accordance with the Schlumberger Technology Corporation (STC) Master Environmental Services Agreement, CH2M personnel are authorized to sign waste profiles and manifests on behalf of STC as an authorized agent for the generator. The signed profile will then be submitted to the disposal facility for waste acceptance and approval.

The nonhazardous profile typically requires the following information:

- Generator information, including name, address, contact, and phone number
- Site name, including street/mailing address
- Process generating waste (for example, source removal)
- Source of contamination (for example, degreasing operations)
- Historical use for area
- Waste composition (for example, 95 percent soil, 5 percent debris)
- Physical state of waste (for example, solid, liquid, etc.)

CH2M will coordinate with the disposal subcontractor to schedule the transportation of the waste to the offsite disposal facility after the copy of the approved waste profile or approval letter is received.

2.5 General Waste Management Requirements

Waste containers will be transported from the generation point to a designated waste accumulation area while awaiting waste characterization results. Appropriate emergency response equipment will be provided at waste staging areas. Drums containing liquid waste will be placed in secondary containment. Spill control equipment, such as sorbent pads, will be available in the storage area, and where liquids are transferred from one vessel to another.

Hazardous wastes will be segregated from nonhazardous wastes. Additionally, incompatible wastes (for example, flammable and corrosive wastes) will be segregated. Wastes of the same matrix, contamination, and the same source may be aggregated to facilitate storage and disposal. All containers will be inspected upon arrival at the site for equipment in disrepair and any contamination or contents. If container contains waste upon arrival or is in disrepair, it will be immediately rejected and documented.

2.5.1 Drums and Small Containers

The following guidelines relate to drums and small containers:

- Drums containing liquid waste (or hazardous waste) will be placed in secondary containment and will not be located near a storm water inlet or conveyance.
- Adequate aisle space (for example, 30 inches) will be provided for containers such as 55-gallon drums to allow the unobstructed movement of personnel and equipment. A row of drums should be no more than two drums wide for inspection and emergency response purposes.
- Each drum or small container will be provided with its own label, and labels will be visible for inspection purposes.
- Drums will remain closed, except when removing or adding waste to the drum. Closed means that the lid and/or bung must be on and securely tightened.
- Drums will be disposed of with the contents.

ENVIRONMENTAL MANAGEMENT PLAN: IN SITU THERMAL TREATMENT, FORMER DOWELL DEPEW FACILITY, DEPEW, NEW YORK

2.5.2 Waste Accumulation Time Limit

Nonhazardous wastes should be removed from the site as soon as practical, there is no specific time limit for nonhazardous waste. The accumulation start date will be placed on each drum label. The accumulation start date for each container is the date that waste is first placed in the container.

2.5.3 Labels

Waste containers will be labeled in accordance with 40 CFR Part 264, 265, 49 CFR, and 6 NYCRR Part 372 requirements. Containers used to store/accumulate waste will include one of the following labels at all times:

- "Analysis Pending"—Temporary, handwritten label used until analytical results are received and reviewed. The label will be marked with the type of waste (such as "contaminated soil" or "contaminated water"), the accumulation start date, and generator point-of-contact.
- "Hazardous Waste" labels with the following information:
 - Accumulation start date
 - Generator name, address, phone
 - USEPA identification (ID) number
 - RCRA Waste codes
 - Manifest number (for containers less than 110-gallon capacity) to be added prior to shipment
- "Nonhazardous Waste" labels with the following information:
 - Generator name
 - Waste-specific information (for example, contaminated soil or contaminated water)
- Where applicable, the major hazard labels (flammable, oxidizer, and carcinogen) will be included on the container prior to transportation.

2.5.4 Inspection of Waste Storage Areas

Waste storage areas will be inspected at least weekly for conditions that could result in a release of waste to the environment. Inspections will focus on conditions such as equipment malfunction, container or containment deterioration, and signs of leakage or discharge. Specifically, containers will be inspected for leaks, signs of corrosion, or signs of general deterioration.

Deficiencies observed or noted during inspection will be corrected immediately. Appropriate measures may include transferring waste from a leaking container to a new container, replacing the liner or cover, or repairing the secondary containment berm.

Inspections will be recorded in the project logbook or on an inspection form (Attachment 1). Deficiencies and corrections also will be documented. The following items will be noted in the logbook or inspection form for each inspection:

- Location of the area
- Total number of containers present
- Date
- Verification that containers are labeled with the accumulation start date, contents, emergency point of contact (CH2M); labels must be visible, legible, and not faded
- Condition of containers; good condition for containers defined as no severe rusting, dents, structural defects, or leaks

- Verification that containers are completely closed with bolts, lids, and locking mechanisms engaged as though ready for immediate transport; lids must seat firmly and gaskets must be intact
- Verification that containers are staged in rows not more than two drums wide, with labels facing outward and 3 feet of space between rows
- Verification that the secondary containment for liquid containers is in good condition with no tears or holes
- Verification that containers are being tracked on the transportation and disposal log
- Verification that the accumulation area is clean and free of debris
- Verification that emergency response equipment is present (if required) for the waste being staged

2.6 Training

Field personnel managing hazardous or potentially hazardous waste will meet the hazardous waste generator training requirements of 40 CFR 265.16 through the following:

- Occupational Safety and Health Administration 1910.120 Hazardous Waste Operations and Emergency Response training, including the Remediation Waste Management Module from the internal CH2M course
- Dangerous Goods Shipping training (online course for CH2M staff)
- On-the-job training that includes the following:
 - Site-specific health and safety plan review—each site worker and guests must review and sign the plan
 - Activity hazard analysis and daily "tailgate" meetings
 - Project-specific review of this environmental management plan

Loads will be covered and the trucks inspected to verify that the loads are secure, proper placarding is provided as necessary, and shipping documentation is accurate. Waste will be tracked on a transportation and disposal log located on the SharePoint site. An example log form is included in Attachment 2.

3.1 Transportation and Disposal Documentation

Before offsite disposal of nonhazardous waste, CH2M will review the waste approval package for each waste stream. This package will include a waste profile naming STC as the generator of the waste; analytical summary table(s) applicable to the waste; letter of approval from the proposed waste disposal facility to accept the waste; a completed waste manifest; and any other applicable information necessary to complete review of the disposal package and provide signature as the generator.

CH2M's waste coordinator has the authority to sign on behalf of and as an agent for STC and will sign profiles. Transportation documentation (such as manifests) will be signed by onsite CH2M personnel as STC's designated representative. Manifest instructions will be provided to CH2M onsite personnel by the project waste coordinator to facilitate waste pickup.

The signed profile will be submitted to the disposal facility for acceptance and approval. Once the approval letter is received from the disposal facility, transportation will be scheduled.

Each load of waste will be manifested before leaving the site. Hazardous wastes must be manifested on USEPA Uniform Hazardous Waste Manifests. Nonhazardous waste will be manifested on nonhazardous waste manifests. Before shipping wastes, manifests will be reviewed and approved by the project waste coordinator. At a minimum, the manifest form will include the following information:

Generator information as follows:

Schlumberger Technology Corporation Generator's Agent: CH2M 14701 St. Mary's Lane, Suite 300 Houston, TX 77076 Attn: Heather McColgin-Dial

- Transporter information, including name (USEPA ID number for hazardous waste)
- Facility information, including name, address, phone number (USEPA ID number for hazardous waste)
- Site name, including street address at a minimum, and mailing address if available
- Type and number of container(s)
- Quantity of waste (volumetric estimate)
- Profile number
- 24-hour emergency phone number

The onsite CH2M representative and the transporter must sign the manifest before the load of waste leaves the site. The back copy of the original manifest will be retained in the project file. The original signed manifest will be returned to the agent for the generator as indicated above. If the signed hazardous waste manifest from the designated offsite facility is not received within 35 days, the transporter or the designated facility will be contacted to determine the status of the waste.

3.2 Transporter Requirements

Offsite disposal trucks will be equipped with appropriate appurtenances (for example, lift gate, etc.) in acceptable working condition.

Each transportation vehicle and load of waste will be inspected before leaving the site and documented. The quantities of waste leaving the site will be documented, at a minimum on the transportation and disposal log (Attachment 2). All transporters will be permitted and licensed as required by 6 NYCRR Part 364 for commercial transportation of nonhazardous wastes. For hazardous wastes, the transporter will have a USEPA ID number and will comply with transportation requirements outlined in 49 CFR Sections 171-179 (Hazardous Materials Regulations) and 40 CFR Section 263.11 and Section 263.31 (Hazardous Waste Transportation). A copy of the documentation indicating the selected transporter has appropriate licenses will be received and approved by CH2M before transport of waste.

The transporter will observe the following practices when hauling and transporting wastes offsite:

- Minimize impacts to general public traffic.
- Repair road damage caused by construction or hauling traffic.
- Verify that seals on trucks transporting liquids are in good condition.
- Decontaminate vehicles before reuse.
- Wastes or materials from other sites may not be combined with wastes generated during the project.

Personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in the health and safety plan.

Loads will be inspected to ensure the loads are secure, proper placarding is provided as necessary, and shipping documentation is accurate.

3.3 Disposal Requirements

Offsite disposal facilities will use the waste profile and supporting documentation, such as analytical results, to determine if the facility will accept a waste. The disposal facility will be responsible for providing a copy of the final waste manifest and for a certificate of treatment or disposal for each load of waste received. Wastes are expected to be disposed as follows:

- Nonhazardous wastes will be disposed in a facility permitted to accept these types and quantities of waste (for example, Subtitle D landfills).
- Hazardous waste are not expected but will be sent to a permitted Subtitle C facility for treatment and/or disposal.
- GAC will be sent for regeneration if amenable or for offsite disposal in accordance with waste characterization analytical results.
- Uncontaminated or decontaminated materials may be sent to municipal landfills.

3.4 Recordkeeping

The following records and documents will be maintained:

- A transportation and disposal log will be kept separately from the project logbook that contains the following minimum information for each container as it is generated:
 - A specific ID number corresponding to each container generated at the site (the container will be marked with the same ID)
 - The date that waste was first placed in the container (accumulation start date)
 - The profile number associated with the waste
 - The date that the container was transported for final disposal and the name of the transporter moving the container
 - Manifest number (offsite disposal only)

- Transportation and offsite disposal records, including the following:
 - Profiles and associated characterization data
 - Facility-signed manifests and certificates of disposal/destruction (to be kept in project file)
- Training records
- Inspection records

Spill Prevention and Control

Procedures and controls regarding spills can be found in the site-specific health and safety plan. The CH2M field team leader will report a release of waste, chemical, or material to the CH2M project manager and EM or their designated representative. The definition of release includes "spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment, including the abandonment or discarding of barrels, containers, and other closed containers" of a chemical, substance, and/or material. The greatest risk to the environment during implementation of the project is the potential for spills to occur during activities associated with the fieldwork operations. The risk is associated with both the remediation chemicals and other hazardous materials (such as vehicle fuels and lubricants) that will be used on the project. The following subsections describe the procedures and controls that will be used to prevent spills as well as the procedures and reporting process to be implemented in the event that a spill occurs.

4.1 Spill Prevention

Bulk fuels and chemicals are not expected to be kept onsite. Small quantities of fuels (5 to 10 gallons) may be kept onsite in approved containers. Best management practices as described below will be observed during remediation activities.

4.1.1 Secondary Containment/Ground Surface Protection

Measures to contain spills and/or protect the ground surface will be deployed during the work as needed to minimize the possibility of environmental impacts from spills. The controls are required when the following occurs:

- To support equipment without built-in containment that is operating or idling (compressors, generators, etc.)
- Under heavy- and light-duty parked equipment that is operating or idling over 15 minutes (drill rigs, excavators, generators, forklifts, trucks, etc.)
- During fluid transfers at connection points, from connection to disconnection
- For bulk material containers, although not expected to be used during this project
- For hazardous material containers, both when stored and when being used in a work area
- For waste containers

Secondary containment and general environmental protection will be based on the equipment and scenario and will be thoroughly review by the EM with the project team prior to mobilization (that is, in an operational readiness review, or equal). Some examples may include, plastic sheeting placed under a drill rig to prevent small hydraulic fluid leaks from contacting the ground, and absorbent pads placed under the transfer point when using a portable fuel can to refuel a generator.

4.1.2 Good Housekeeping

A clean and orderly work area reduces the possibility of accidental spills caused by mishandling chemicals and equipment and reduces safety hazards. The following practices will be incorporated into the field activities as part of good housekeeping practices:

- Garbage, waste materials, and construction debris will be regularly picked up and disposed of.
- The site will be maintained in an orderly condition.
- Materials will be kept in their original containers whenever possible, maintaining original labels and safety data sheet.

- Surplus materials will be properly disposed of.
- Position equipment so that valves, tanks, lines, etc., are protected from damage during ongoing operations.

4.1.3 Preventive Maintenance

Preventive maintenance involves the regular inspection and testing of equipment and operational systems. Breakdowns and failures can often be avoided by adjustment, repair, or replacement of equipment.

The following practices will be adhered to as part of preventive maintenance:

- Equipment will be inspected prior to entering site and then daily. Inspections will focus on active or potential leaks, as well as faulty hoses and fittings. Inspections will be documented in the daily logs. Equipment requiring maintenance or repair will not be placed into service.
- Equipment used will be maintained in accordance with the manufacturer's specifications. Maintenance will occur offsite it possible. Regular equipment maintenance will not be performed onsite.
- Before using or moving a vehicle or piece of equipment, perform a 360-degree walk-around. Check for the presence of leaks on the ground, under the vehicle or equipment, and in secondary containment associated with the vehicle or equipment.
- Leak tests using clean water will be used to test the integrity of the injection system prior to performing the injection work with the injected chemicals.

4.1.4 Spill Kits

Adequate spill control materials will be maintained at the local work areas where chemical products or fuels are being used.

At a minimum, for these project activities, oil absorbent pads will be kept onsite during use of any fuel burning or hydraulic equipment.

4.2 Spill Containment and Control

This section describes response activities should any leaks or spills occur.

Incidental spills will be contained and cleaned up with sorbent, and the used sorbent materials will be disposed in accordance with the waste management section of this plan. Spilled materials must be immediately contained and controlled. Spill response procedures include the following:

- Immediately warn nearby workers and shut down site operations.
- Assess the spill area to determine if it is safe to respond.
- Evacuate site personnel area if spill poses an immediate health endangerment. The site safety and health officer will designate an evacuation assembly point before beginning work.
- Dial 911 if the size or nature of spill warrants professional emergency response.
- Immediately eliminate nearby ignition sources.
- Stop the source of the spill.
- Establish site control for the spill area.
- Contain and control spilled material through use of sorbent booms, pads, or other means.
- Use proper PPE in responding to spills.
- Notify the CH2M project manager, EM, and health and safety manager, who will implement additional needed notifications.

4.3 Spill Cleanup and Removal

Material that is spilled or released will be contained immediately if safe and as appropriate for the spilled medium (liquid or solid), and the area cleaned up to the extent practicable. Containerized material will be characterized and managed in accordance with the waste management section of this plan. Following spill cleanup, the cause of the spill will be investigated, and material storage and handling procedures will be reviewed and revised where appropriate.

Protection of Air Quality

As previously described, air permitting is not expected to be required for this project.

It is anticipated that the associated field activities will have minimal potential to discharge air pollutants; however, the following general practices will be implemented to protect air quality:

- Vehicles, drill rigs, and other motorized equipment will be maintained within manufacturer's design limits so that there is minimal discharge of exhaust emissions.
- Daily equipment inspections will be performed.
- Burning of materials is not allowed for the project.

Protection of Water Quality

It is anticipated that work activities performed while executing this project will have minimal potential to affect surface water quality because of the following:

- There will be no bulk storage of fuels or chemicals.
- The scope of the work activities is relatively limited in extent and duration.
- Spill prevention measures discussed in this document and in the site-specific health and safety plan will be implemented throughout the project to minimize potential for environmental impacts due to spills.

Wetlands are in proximity to the site on the south; however, the small quantity of fuels expected to be onsite results in a minimal chance that a release to a waterway will occur. In addition, spill response materials will be onsite and spill response procedures are in place.

As previously discussed, an agreement will be obtained with the City of Depew POTW to discharge to the sanitary sewer. If such an agreement cannot be obtained, liquids produced will be containerized, properly characterized for waste disposal, and disposed offsite.

As previously discussed, if ERH is the selected ISTT, a UIC permit would be required by USEPA Region 2 to allow the addition of water to keep the soil moist and conductive. The activity is permitted by rule, but requires a notification of site and activity information to the agency.

Protection of Vegetation

No clearing of vegetation is anticipated for the project. Should vegetation clearing be required, this plan will be revised.

Protection of Fish and Wildlife

According to the July 16, 2012, listing of endangered and threatened species in New York, there are no federally listed species that occur in Erie County. New York has state-listed endangered and threatened species and species of special concern, the majority of which are not expect to be encountered on the project site. The listed birds may have the potential to be encountered and will also be protected under the Migratory Bird Treaty Act.

Under the Migratory Bird Treaty Act, prohibited acts include pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting such conduct.

In order to comply with wildlife protection regulations, wildlife encountered will not be harassed, harmed, pursued, hunted, shot, wounded, killed, trapped, captures, or collected unless by U.S. Fish and Wildlife Service personnel. Active bird nests will not be disturbed.

Site Restoration

For this type of project, site restoration is minimal in nature and typically consists of ensuring that a material or item procured and brought to the site is properly stored, disposed of, or demobilized. It is the responsibility of the CH2M field team leader to verify that materials that are brought to the site are removed during demobilization unless those materials were specifically intended to remain, such as spare sampling containers, tubing, and disposable equipment. If items require disposal and are not included as part of this plan, the CH2M EM should be consulted for guidance.

Specific site restoration details will be finalized as part of the design process and will be reviewed by the EM to be compliant with federal, state, and local regulations and ordinances.

Key Points of Contact

This environmental management plan refers to project team members as points of contact for a variety of issues and situations. Table 10-1 shows the roster of individuals, their contact information, and backup points of contact.

Table 10-1. Project Team Contact Information

Environmental Management Plan

Former Dowell Depew Facility, Depew, New York

Role	Primary	Backup
Project Manager	Jayson Burkard/STL	Cathy Barnett
	Cell: 314-477-7284	Cell: 314-479-4454
	E-mail: <u>Jayson.Burkard@CH2M.com</u>	E-mail: cathy.barnett@ch2m.com
Environmental Manager	Linda Colella/DEN	Liz Luecker/SEA
	Cell: 720-320-2590	Cell: 425-647-6073
	E-mail: <u>linda.colella@ch2m.com</u>	E-mail: liz.luecker@ch2m.com
Health and Safety Manager	Eric Hamm/SCO	Mark Orman/KNV
	Cell: 626-644-2563	Cell: 414-712-4138
	E-mail: Eric.Hamm@ch2m.com	E-mail: <u>mark.orman@ch2m.com</u>
Waste Manager	Lisa Schwan/ATL	Jody Sanchez/RDD
	Cell: 404-414-2505	Work: (530) 941-1647
	E-mail: <u>lisa.schwan@ch2m.com</u>	E-mail: <u>Jody.Sanchez@CH2M.com</u>

In the event of a spill, contact the project EM and project manager. Spill reporting will be coordinated through STC. External contact information is provided in Table 10-2 for ease of reference; however, the project team should work through the project EM and project manager.

Table 10-2. External Contact Information

Environmental Management Plan

Former Dowell Depew Facility, Depew, New York

Agency	Contact Information					
	National Response Center: 1-800-424-8802					
	NYS Spill Hotline: 1-800-457-7362					
State Emergency Planning Commission	Mr. William R. Davis Jr., Chairman New York State Emergency Response Commission 1220 Washington Avenue, Building 22, Suite 101 Albany, NY 12226-2251					
	Phone: 518-292-2302 Fax: 518-322-4986 E-mail: <u>serc@dhses.ny.gov</u> Webpage: <u>http://www.dhses.ny.gov/oem/disaster-prep</u>					
Local Emergency Planning Committee	Dan McCartan, Chair Erie County Local Emergency Planning Committee 45 Elm Street Buffalo, NY 14203 Phone: (716) 858-3928 E-Mail: eclepc@gmail.com					

Attachment 1 Waste Accumulation Area Inspection Form

Waste Accumulation Area Inspection Log

Site:	TO:							
Inspected by:	Time: Date:							
Signature:	Accumulation Area Location:							
No. of Containers: No. of Tanks:	No. of Rolloff Boxes: No. of Stockpiles:							
Waste Containers, Tanks, and Rolloff Boxes								

Waste Containers, Tanks, and Rolloff Boxes						
	Yes	No				
Are rolloffs, drums, tanks closed?						
Drums: lids, rings on and fit well, bolted tight						
Rolloffs: bows and tarps on, cover all of rolloff and tarp tightened down						
Tanks: lid/cover is on and tight						
Containers (drums, rolloffs with slop/liquids, tanks) are in secondary containment?						
Containers are in good shape (e.g., no rust, bulges, creases, fluid level drop, etc)?						
Drums, tank, rolloff boxes are appropriately labeled, readable, and visible? (e.g., "Hazardous Waste", "Nonhazardous Waste", "Analysis Pending") If data back, label must be changed out immediately from "analysis pending."						
Accumulation start date marked on all drums, tanks, rolloffs? (date first drop of waste is placed into container)						
Labels are completely filled out?						
If any of these questions were marked NO , please add comment and corrective actions:						

Soil Stockpiles							
	Yes	No					
Liner is secure and intact?							
Berm is secure and intact?							
Cover is in place and secure (if necessary)?							
If any of these questions were marked NO , please add comment and corrective actions:							

Temporary Waste Storage Areas							
	Yes	No					
Secondary containment - NO signs of failure (e.g., ripped liner, berm failure, stained soil, sheen in 2 nd containment)?							
Drums are on pallets?							
Drums are covered with visqueen or tarp?							
Secondary containment is free of liquid?							
Accumulation Area is designated with other appropriate signage (Temporary Waste Storage; Emergency contact and phone number)							
If any of these questions were marked NO, please add comment and corrective actions:							

Emergency Response Equipment in Waste Storage Areas									
		Yes	No						
	Easily accessible in case of emergency?								
Telephone/Radios	In working order?								
	Is unused absorbent material nearby?								
Spill Control	Decontamination equipment available?								
Spill Control	Is personnel protective equipment available?								
	Is a fire extinguisher readily accessible?								
Fire Protection	Is the fire extinguisher fully charged and seal intact?								
If any of these questions wer	e marked NO , please add comment and corrective actions:								
1									

Paperwork								
	Yes	No						
T&D/Waste Tracking Log is up to date								
Inspections completed weekly and documented								
If any of these questions were marked NO , please add comment and corrective actions:								

Attachment 2 Transportation and Disposal Log

Transportation and Disposal Log Project Name/Number: Dowell Depew, Depew, New York PAGE # __1____

Site/Task Description	Container Type	Temporary Storage Location	Truck &Trailer License Plate No.	Transporter	Accumulation Start Date (date generated)	Date Trans-ported offsite	Time Left Site	Disposal Facility	Matrix (water, PPE, spent bag filters)	Waste Type (Haz, Nonhaz, TSCA)	Disposal Facility Date (found on final manifest)	Manifest Number	Final Weight	Units	Disposal Facility Signed Manifest in Hand

Appendix E Community Air Monitoring Plan

Appendix 1A New York State Department of Health Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is 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 action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all <u>ground intrusive</u> activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during <u>non-intrusive</u> activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. 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 must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. 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 must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can 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.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should 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. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/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 must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m³ of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

- (a) Objects to be measured: Dust, mists or aerosols;
- (b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);

(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;

(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);

- (e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
- (f) Particle Size Range of Maximum Response: 0.1-10;
- (g) Total Number of Data Points in Memory: 10,000;

(h) Logged Data: Each data point with average concentration, time/date and data point number

(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;

(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;

(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;

(1) Operating Temperature: -10 to 50° C (14 to 122° F);

(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential-such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

- (a) Applying water on haul roads;
- (b) Wetting equipment and excavation faces;
- (c) Spraying water on buckets during excavation and dumping;
- (d) Hauling materials in properly tarped or watertight containers;
- (e) Restricting vehicle speeds to 10 mph;
- (f) Covering excavated areas and material after excavation activity ceases; and
- (g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.