

2011 Groundwater Monitoring Work Plan Martin State Airport 701 Wilson Point Road Middle River, Maryland

Prepared for:

Lockheed Martin Corporation

Prepared by:

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ACRONYMS

AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CAH	chlorinated aliphatic hydrocarbons
cis-1,2-DCE	cis-1,2-dichloroethene
CPT	cone-penetrometer tests
DCE	dichloroethene
DO	dissolved oxygen
DPT	direct-push technology
ECD	electron-capture device
EESH	energy, environment, safety and health
EGIS	Environmental Geographic Information System
FOL	field operations leader
GIS	geographic information system
HASP	health and safety plan
IDW	investigation-derived waste
Lockheed Martin	Lockheed Martin Corporation
MAA	Maryland Aviation Administration
MCL	maximum contaminant level
MDE	Maryland Department of the Environment
MES	Maryland Environmental Service
NAA	Natural Attenuation Assessment
µg/kg	microgram per kilogram
µg/L	micrograms per liter
MIP	membrane-interface probe
ml/min	milliliters per minute
MSA	Martin State Airport
msl	mean sea level
ORP	oxygen-reduction potential
PCBs	polychlorinated biphenyls
PDF	Portable Document Format
PM	project manager

PPE	personal protective equipment
QA/QC	quality assurance, quality control
RDX	cyclotrimethylene-trinitramine or royal demolition explosive
SDG	sample delivery group
SVOC	semivolatile organic compounds
Tetra Tech	Tetra Tech Inc.
TCE	trichloroethene
TDS	total dissolved solids
TIC	tentatively identified compounds
USEPA	United States Environmental Protection Agency
USDOT	United States Department of Transportation
VC	vinyl chloride
VOC	volatile organic compound

Section 1

Introduction

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech Inc. (Tetra Tech) has prepared the following work plan for groundwater and surface water sampling and monitoring in 2011 at the Martin State Airport (MSA) in Middle River, Maryland (see Figure 1-1). The sampling objectives are to:

- provide a current round of groundwater data for selected monitoring wells
- better understand the nature and extent of contamination in groundwater
- evaluate time-based trends of on-site groundwater plumes
- evaluate the natural attenuation of the chemicals of concern in groundwater at Martin State Airport
- evaluate interaction between shallow groundwater and Frog Mortar Creek
- provide information that can be used to update the modeling of shallow groundwater-flow patterns and discharge to Frog Mortar Creek

Meeting these and related objectives is essential in the selection and implementation of cost-effective site remediation.

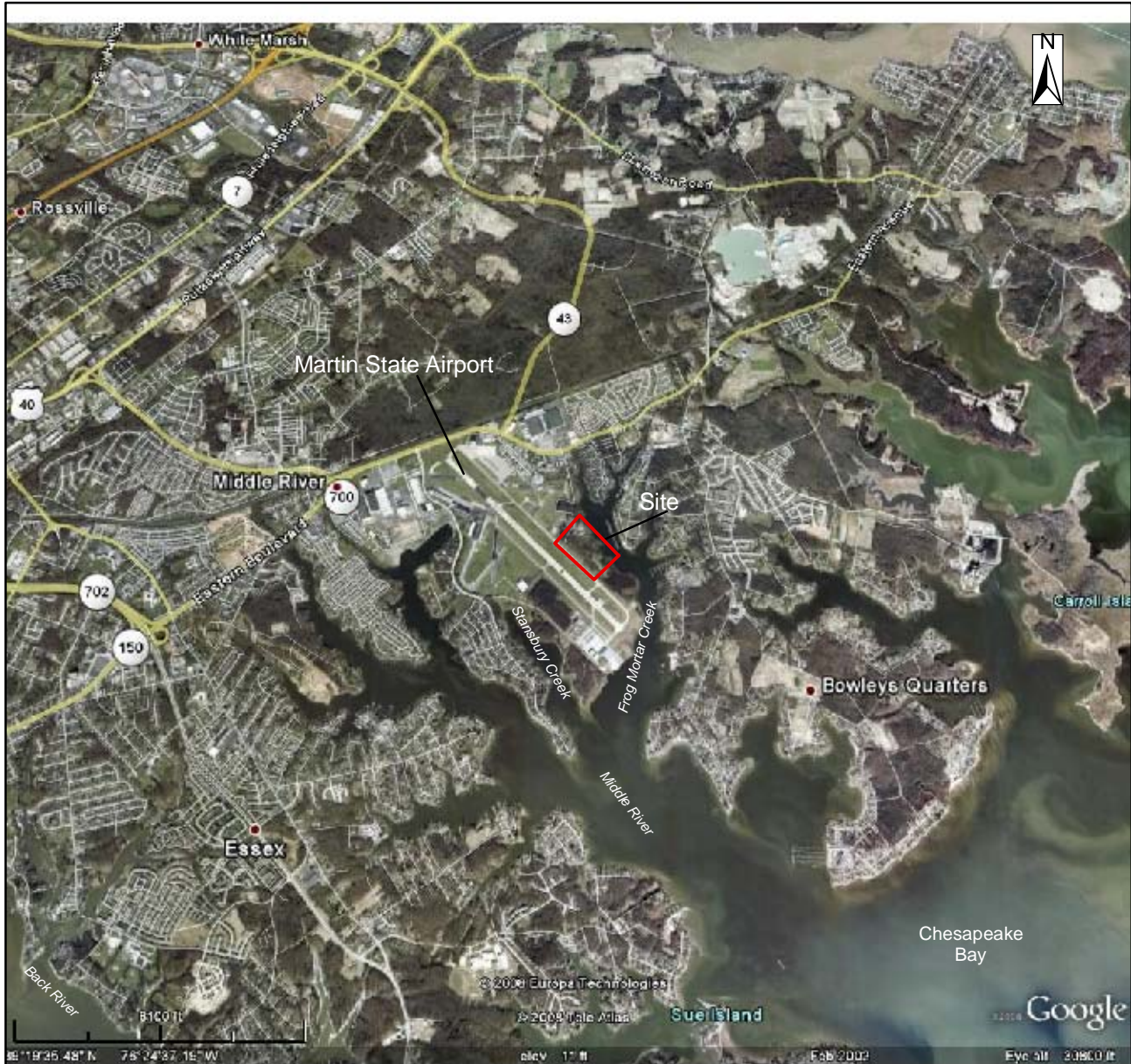
This work plan is organized as follows:

Section 2 — Site Background: Briefly describes site history, subsurface conditions, and previous investigations.

Section 3 — Investigation Approach and Methodology: Presents the technical approach to groundwater monitoring and describes the field methodology to be employed.

Section 4 — Project Deliverables: Describes the final report summarizing the investigation findings.

Section 5 — References: Cites references used to compile this work plan.



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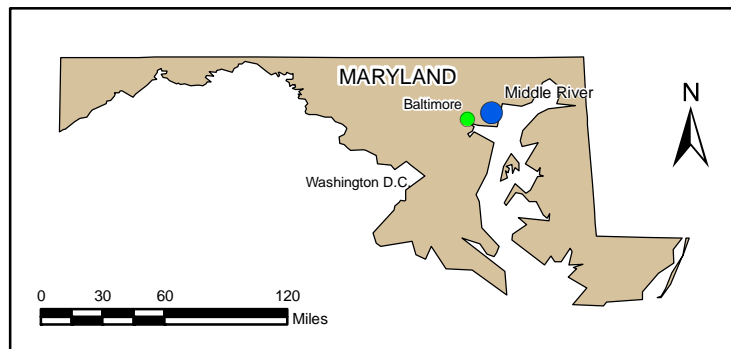


Figure 1-1

**Site
Location Map**

***Martin State Airport
Middle River, Maryland***

DATE MODIFIED:

12/04/08

CREATED BY:

MP



Tetra Tech, Inc.

Section 2

Site Background

2.1 MARTIN STATE AIRPORT BACKGROUND

Maryland State Airport (MSA) is located at 701 Wilson Point Road in Middle River, Maryland, bounded by Frog Mortar Creek to the east and Stansbury Creek to the west (see Figure 1-1). Both creeks join Chesapeake Bay at the south side of the airport. The area under investigation is in the southeast portion of the MSA, bounded by Frog Mortar Creek to the east and the main airport runway to the west. The investigation area was initially identified in July 1991, when the Maryland Aviation Administration (MAA) encountered four buried drums adjacent to Taxiway Tango during trenching activities to install an electrical cable. Discovery of these drums led to investigation of the surrounding area for possible soil and groundwater contamination, as required by the Maryland Department of the Environment (MDE) in their January 6, 1992 and January 14, 1997 letters to MAA.

2.2 REGIONAL GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

MSA is in the western shore of the Coastal Plain Physiographic Province. Regional and local studies (Vroblesky and Fleck, 1991; Chapelle, 1985) indicate that the MSA facility lies on the Patapsco geologic formation. This formation consists of complex and inter-bedded mixtures of gray, brown, and red sands, silts, and clays originating from sediment deposition in a low coastal-plain traversed by low-gradient meandering streams. Below the Patapsco Formation lies a regionally extensive, thick, clay confining-unit known as the Arundel Formation, a massive, impermeable unit underlying the site and surrounding area.

The Arundel Formation outcrops northwest of the site and dips and thickens to the southeast, extending as far east as Cambridge, Maryland, where it is more than 600 feet thick. Regional lithologic information indicates that the Arundel Formation may be as much as 100–150 feet thick at MSA (Vroblesky and Fleck, 1991; Chapelle, 1985). The formation most likely acts as an

impermeable barrier to the downward movement of any constituents found in the surficial aquifer. Southwest of MSA, the base of the Arundel Formation, where it lies upon the top surface of the deeper Patuxent Formation has been mapped at 170–300 feet below mean sea level (msl) (Vroblesky and Fleck, 1991; Chapelle, 1985). These regional studies indicate that the base of the Arundel Formation may occur at 250–300 feet below msl. Consequently, the depth to the base of the Arundel Formation may range from 270–320 feet below ground surface (bgs) at MSA.

The Patuxent Formation, a multi-aquifer unit, comprises various inter-bedded layers of sand, silt and clay with abrupt changes of deposited material types over short distances. Permeable, sand-rich units range from bounded sand sheets to isolated sand bodies (Glaser, 1969). In the MSA area, groundwater flows to the south and southwest, in response to industrial wells withdrawing water southwest and west of the site (Chapelle, 1985 and Curtin, 2006).

2.3 MARTIN STATE AIRPORT SUBSURFACE CONDITIONS

At MSA, numerous shallow and deep-soil borings have been advanced to collect soil samples for lithologic information and chemical analyses. Previous studies at the Site indicate that the subsurface geology at MSA consists of highly heterogeneous mixtures of unconsolidated sediments of gravels, sands, silts, and clays. A layer of fill consisting of heterogeneous sands, silts, and clays overlies native soils.

(Refer to Section 3 for groundwater monitoring-well locations listed in the following section.) A review of boring logs for groundwater monitoring wells MW5, DMW7S, and MW7 indicates that a heterogeneous mixture of clay, silt, and some silty sand predominates to a depth of approximately 25 feet bgs (five feet below mean sea level [msl]), underlain by poorly graded fine-sand with occasional silt lenses to a depth that ranges from approximately 32 to 42 feet bgs (11–21 feet below msl). At groundwater-monitoring wells DMW7S and MW7, silt and clay predominate from 32–39 feet deep (11–19 feet below msl). At well MW5, the geology consists predominantly of poorly graded, fine sand to 42 feet bgs (19 feet below msl) at its termination point.

The groundwater-monitoring wells are screened in the surficial-aquifer system (the Patapsco Formation) at different elevations to provide hydrologic and chemical data across the entire

water-bearing zone. For data evaluation and correlation, the aquifer is divided into upper, intermediate, and lower surficial-aquifer zones. Twenty-seven groundwater monitoring wells (DMW1S through DMW11S, MW3 through MW7, MW15S through MW18S, MW20S, MW23S through MW26S, RW1S, and OW1S) are screened in the upper surficial-aquifer, which is the portion from the ground surface to an elevation of approximately 15 feet below msl.

Generally, the upper surficial-aquifer consists of fill that occurs within the uppermost 10-20 feet bgs, with native soils beneath the fill materials. Locally, (i.e., DMW7S and MW7) an eight-foot thick, low-permeability zone (i.e., an aquiclude) is present between the upper surficial-aquifer and the intermediate surficial-aquifer. In some areas of the site the aquiclude restricts groundwater flow and retards contaminant movement between the upper and intermediate surficial-aquifer zones. However, the low-permeability zone is localized and limited in extent and was not encountered at MW5, thus providing a direct pathway for migration to deeper zones from surface-released chlorinated solvents.

Twenty-nine groundwater monitoring wells (DMW1A, DMW2A, MW1, MW2, DMW3I through DMW11I, MW14I through MW26I, MW28I, RW1I, and OW1I) are screened in the intermediate surficial-aquifer, which is between 15–45 feet below msl. Twenty groundwater monitoring wells (DMW1B, DMW2B, DMW3D through DMW9D, MW14D through MW23D, and MW26D) are screened in the lower surficial-aquifer, which is from approximately 45 to 73 feet below msl. At an elevation of approximately 45 feet below msl, a thin, clay, aquitard lies between the intermediate and lower surficial-aquifers.

Four wells (MW27D, MW29D, MW30D and MW31D) are screened in deep, confined aquifers underlying the lower surficial aquifer. The deep well logs indicate that alternating sand and silt aquifers and clay aquitards are present beneath the lower surficial aquifer. Lithologic data from the four deep wells indicate the presence of 6 to 40 feet of clay beneath the lower surficial aquifer. Beneath this clay bed are a series of alternating sand and clay layers with top surfaces occurring at approximate elevations of 120 to 130 feet below msl (sand), 140 to 160 feet below msl (clay), 190 feet below msl (sand), 197 to 205 feet below msl (clay), and 245 feet below msl (sand at MW29D only).

A series of alternating sand and silt aquifers and clay aquitards were encountered beneath the lower surficial-aquifer. Permeability tests on the aquitard clays indicate low vertical-permeabilities, ranging from 2.2E-08 to 13.0E-08 centimeters per second. A single-well, directional, heat-pulse technique successfully estimated groundwater-flow directions at groundwater-monitoring wells MW27D and MW29D. These results were used to locate down-gradient groundwater-monitoring wells MW30D and MW31D.

Groundwater in the deep confined aquifers flows in a southeasterly direction from MW27D through MW31D towards MW29D. Groundwater elevations for groundwater-monitoring wells MW28I and MW27D indicate an upward hydraulic gradient of 0.0035.

2.4 DESCRIPTION OF HISTORICAL AREAS OF CONCERN

From 1992–1996, MAA conducted several investigations at the southeast portion of MSA. These included a geophysical survey of Taxiway Tango (Handex, 1992), a preliminary site investigation of Taxiway Tango (Maryland Environmental Service [MES], 1994), a confirmation investigation of Taxiway Tango (MES, 1995), and an expanded investigation of Taxiway Tango (MES, 1996). Results of these investigations identified four areas of concern:

- 1) Taxiway Tango Median Anomaly-Area — After four buried drums were removed in 1991, a geophysical survey was conducted throughout the area adjacent to Taxiway Tango. Several anomalous zones were identified as possibly containing buried metal.
- 2) Drum Area — Several drums were uncovered when surface vegetation was cleared during a 1996 site investigation.
- 3) Two Existing Ponds — Historical records indicate that acids may have been discharged during the 1950s and 1960s at the present location of two ponds.
- 4) Petroleum Hydrocarbon Area — Petroleum hydrocarbons were encountered while drilling a soil boring during a 1996 site investigation. The Petroleum Hydrocarbon Area is approximately 200 feet west of the ponds.

Trichloroethene (TCE) and TCE-degradation daughter-products were detected throughout the investigation area, with the highest concentrations appearing in the upper and intermediate surficial-aquifer. At MSA, previously detected concentrations of TCE range from 0.5 to more than 100,000 micrograms per liter (µg/L). 1,4-Dioxane, typically co-located with chlorinated solvents, is also considered a chemical of concern. TCE-degradation daughter-products

(e.g., dichloroethene [DCE], vinyl chloride [VC], etc.) are typically co-located with TCE at MSA.

2.5 PREVIOUS INVESTIGATIONS

- **March 1999: Initial Groundwater Monitoring-Well Sampling**— Lockheed Martin first evaluated the site in March 1999, sampling six, existing, groundwater-monitoring wells to obtain updated chemical data on groundwater quality, elevation, and flow direction at the southeast portion of MSA. TCE, cis-1,2-dichloroethene (cis-1,2-DCE), and VC were detected in select monitoring wells at concentrations exceeding Maryland groundwater standards and United States Environmental Protection Agency (USEPA) “National Primary Drinking Water Maximum Contaminant Levels” (MCLs). A detailed description of the groundwater-sampling program is provided in the May 1999 *Final Groundwater Monitoring-Well Surveying and Sampling Report*. Detection of elevated volatile organic compounds (VOCs) in the existing monitoring wells led to further investigation of the site to identify potential chemical source areas.
- **March through May 2000: Source Identification and Assessment Program**— The second investigation was a “Source Identification and Assessment Program.” MAA had previously identified four specific areas as possibly having been the source of released chemicals. Each of these areas of potential concern was investigated through a combination of excavations, localized trenching, drilling of soil borings, and sampling and laboratory analyses of soil, sediments, and groundwater. VOCs, petroleum hydrocarbons, and metals were detected in the soil and groundwater during this investigation. Only VC was detected above USEPA Region III industrial-soil risk-based concentrations used by MDE. Some VOCs were also detected in the groundwater at levels above the groundwater standards. The results of the investigation are documented in the September 2000 *Final Source Identification and Assessment Report*. The source identification and assessment program identified VOCs in excess of published cleanup criteria; therefore, chemicals in the groundwater were delineated.
- **December 2001 through December 2002: Partial Chemical Delineation and Initial Modeling**— The third investigation further delineated the lateral extent of chemicals in near-surface groundwater at the four source-areas of concern. In addition, deep multi-level monitoring wells were installed at two locations in order to characterize the site geology and vertical extent of groundwater contamination. The deep groundwater-monitoring wells were installed where the highest concentrations of TCE and VC were detected in the shallow-groundwater investigation. A summary of these activities is provided below and also documented in the December 2002 *Final Chemical Delineation and Groundwater Modeling Report*. Data collected during the groundwater investigation indicate that VOCs (primarily cis-1,2-DCE, TCE, and VC) and metals (primarily cadmium) are present in the groundwater above groundwater standards. The lateral and vertical distributions of chemicals in groundwater were not delineated during this phase of the investigation.

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- **July 2003 through March 2004: Data-Gap Investigation and Groundwater Modeling**— The fourth investigation aimed to fully delineate and characterize the chemical plumes at the site and perform groundwater modeling. Nine additional multi-level monitoring wells (DMW3 through DMW11), three shallow groundwater-monitoring wells (DMW1S, DMW2S, and MW7), and four temporary groundwater-monitoring wells (TT11 through TT14) were installed at the site. The lateral and vertical distributions of chemical concentrations in groundwater indicate that three potential source-areas are present at the site, contributing to three primary groundwater-plumes. These source areas and plumes are:

- Plume 1, originating from the Drum Area
- Plume 2, originating from the Petroleum Hydrocarbon and Pond #1 Area
- Plume 3, originating from the Taxiway Tango median area

Three chlorinated VOCs (cis-1,2-DCE, TCE, and VC) and cadmium were reported at elevated concentrations during this investigation. The distribution of VOCs in groundwater suggests that dechlorination of TCE to its daughter products cis-1,2-DCE and VC is occurring. The plumes are migrating along the down-gradient groundwater-flow path from west to east toward Frog Mortar Creek. Although the three plumes represent the primary source areas, the chemicals have commingled to form a single contiguous area of groundwater contamination in the eastern portion of the site approaching Frog Mortar Creek.

Site-specific information was used to develop a conceptual model, including regional setting, soil lithology, aquifer characteristics, and historic and current chemical-concentration data. Numerical modeling predicted groundwater flow and chemical migration in the investigation area. Summaries of the investigation and modeling are documented in the May 2004 *Final Data-Gap Investigation and Modeling Report*.

- **Fall/Winter 2007: Additional Onsite Soil and Groundwater Characterization**— Additional onsite soil and groundwater characterization in September 2007 further delineated and characterized the chemical plumes and provided data supporting evaluation of remedial alternatives. The program included advancing 52 membrane-interface-probe/cone-penetrometer tests (MIP/CPT), and installing 12 new and multi-level (nested) surficial-aquifer groundwater-monitoring wells followed by groundwater sampling. Thirty-one monitoring wells were installed, including shallow, intermediate, and deep monitoring wells. The screens of the nested wells were installed at three separate depth intervals of approximately 30, 50, and 80 feet bgs. Two shallow and two intermediate wells were installed as recovery and observation wells in support of aquifer-hydraulics testing. The existing and newly installed nested wells were sampled for target-contaminants analysis. MIP/CPT screening provided a vertical profile of electric conductivity and VOCs in subsurface soils and groundwater, and identified the source-areas of contamination. The overall objectives of these field activities were to characterize the subsurface soil in the vadose and saturated zones, delineate the lateral

boundaries of contamination in soil and groundwater, and delineate the vertical extent of contamination in soil and groundwater.

The study also used electromagnetic and gamma surveys to identify anomalies in the subsurface that could represent buried waste and possible contaminant source(s). Test pits were excavated at locations identified by the geophysical survey as being either anomalous or non-anomalous, to provide depth of fill, visual identification of buried debris, and soil samples for laboratory analysis. A summary of this investigation is provided below and documented in the June 2008 *Soil and Groundwater Data Report*.

- Elevated electron-capture-device (ECD) responses indicated the presence of Chlorinated aliphatic hydrocarbons (CAHs) at 19 of the 52 MIP locations. The contamination appears to be bounded on the north, south, and west. Significant shallow, vadose-zone soil contamination was observed at two locations: MIP-57 and MIP-58, between Taxiway Tango and the runway.
- Soil and groundwater samples collected from the direct-push-technology (DPT) sampling locations confirmed the presence of CAHs in those borings exhibiting elevated ECD response. The maximum TCE concentration in soil was 7,680 micrograms per kilogram ($\mu\text{g}/\text{kg}$) (MIP-58 at 10 feet bgs; soil samples from a limited number of locations minimally exceeded MDE residential-soil standards. were encountered. The maximum concentration of TCE in groundwater was 68,600 $\mu\text{g}/\text{L}$ (MIP-28, at 34–36 feet bgs), and samples from a number of borings exceeded standards. A range of other CAHs and petroleum hydrocarbons was also detected in these samples.
- Groundwater flow is generally northeast toward Frog Mortar Creek.
- VOCs (CAHs and petroleum hydrocarbons), metals, and 1,4-dioxane are present throughout a large portion of the investigation area, at multiple depths, and at high concentrations.
- The maximum TCE concentration observed in a monitoring-well sample was 41,400 $\mu\text{g}/\text{L}$ (DMW-11I). TCE contamination extends north to an area north of Pond #2, south to DMW-7I, and west to the area between Taxiway Tango and the runway. The contamination appears to be delineated, except for the area north-northwest of MW-15 and MW-26 and south of MW-19.
- The maximum 1,4-dioxane concentration observed in a monitoring well sample was 1,800 $\mu\text{g}/\text{L}$ (DMW-3S). The greatest portion of this contaminant appears isolated to the central portion of the site extending north to MW-18, south to DMW-7, and west to DMW-9.
- The maximum perchlorate concentration observed in a monitoring well sample was 8 $\mu\text{g}/\text{L}$ (DMW-7I); perchlorate in groundwater is generally confined to the area southeast of Pond #2. New monitoring wells were not analyzed for perchlorate.

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- A wide range of metals exceeds MDE standards at locations throughout the site. Exceedances were observed for arsenic, barium, beryllium, cadmium, chromium, lead, nickel, selenium, vanadium, and zinc.
 - The geophysical investigation shows suspected waste present over approximately 19 acres of the site. When areas inaccessible to the investigation, but suspected to contain waste (the areas of Ponds #1 and #2 and east of the ponds), are included, the area of the site suspected of containing waste is estimated at approximately 25 acres. The investigation appears to have delineated the extent of the waste in all directions.
 - The test-pit excavations confirm the presence of waste as determined by the geophysical survey. Soil sampling associated with the test pits shows semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCBs), and metals concentrations above MDE residential standards in many of the test pits excavated in the waste areas. Lesser concentrations of these contaminants are also present in areas not containing waste.
 - **June 2008 through January 2009: Deep Groundwater Investigation**— This investigation sought to determine whether VOCs detected in surficial-aquifer groundwater at the MSA have migrated vertically through clay-rich sediments to the next underlying aquifer. Four groundwater-monitoring wells were installed into a confined aquifer lying beneath the groundwater contamination previously characterized in the surficial aquifer at MSA. A shallow well was also installed in the surficial aquifer at a hydraulically up-gradient location near well MW27D. As part of the investigation, groundwater levels were measured in the newly installed groundwater monitoring wells to determine groundwater-flow direction in the deeper confined-aquifer. Groundwater samples were collected for chemical analyses to assess the presence of VOCs. The following summarizes the investigation and its findings:
 - Four deep-soil borings were advanced to depths ranging from 218–268 feet bgs. A fifth boring for an intermediate surficial-aquifer well was advanced to a depth of 50 feet. Continuous soil-coring was used at each borehole to record lithologic descriptions. Four clay-soil samples from deep borings were collected for geotechnical analyses.
 - A series of alternating sand and silt aquifers and clay aquitards were encountered beneath the lower surficial-aquifer, beginning at approximately 100 feet bgs. Permeability tests on the underlying clay indicate low vertical-permeabilities ranging from 2.2E-08 to 13.0E-08 centimeters per second.
 - A single-well, directional, heat-pulse technique successfully estimated groundwater-flow directions at groundwater-monitoring wells MW27D and MW29D. Results of these tests identified drilling locations for down-gradient groundwater-monitoring wells MW30D and MW31D. Groundwater levels recorded in January 2009 show that these wells are hydraulically down gradient of VOC contamination in the lower surficial-aquifer.

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- Five two-inch-diameter monitoring wells were installed to monitor groundwater levels and quality in the intermediate surficial-aquifer and the deep confined-aquifers beneath the lower surficial-aquifer. Well-bottom completion depths ranged from 50-207 feet bgs. Groundwater samples were collected and analyzed for VOCs, SVOCs, and metals.
 - Groundwater in the deep confined-aquifer flows in a southeasterly direction from MW27D toward MW29D through MW31D. Contaminants potentially introduced into the lower confined-aquifer from the lower surficial-aquifer (i.e., the area of groundwater monitoring wells DMW-1B, DMW8D, and DMW4D) would be monitored effectively by down-gradient groundwater-monitoring wells MW29D, MW30D, and MW31D. Groundwater elevations for groundwater-monitoring wells MW28I and MW27D indicate an upward hydraulic gradient of 0.0035 feet per foot.
 - TCE, DCE, and VC were detected in the groundwater sample from newly installed intermediate surficial-aquifer well MW28I at concentrations exceeding drinking water maximum contaminant levels (MCL)s and Maryland groundwater standards. MW28I was installed at a depth of 50 feet bgs at a location northeast and hydraulically up gradient of the areas of historically high TCE contamination.
 - Chlorinated VOCs, VOC-degradation products, and 1,4-dioxane detected in the lower surficial-aquifer groundwater across the site were not detected in the deep-well groundwater samples. VOCs and SVOCs reported for the deep-well samples are common laboratory contaminants or are constituents of petroleum fuels. Concentrations of the detected VOCs and SVOCs are less than the MCLs and Maryland groundwater standards.
 - **August through September 2008: Groundwater Monitoring**— This monitoring provided a then-current round of groundwater data for older existing groundwater-monitoring wells, and a second round of groundwater data for newly installed monitoring wells at MSA. These data describe then-current groundwater-quality conditions at the facility that support evaluation of time-based trends of groundwater contaminants, and evaluation of remedial actions in subsequent studies. Groundwater samples were chemically analyzed for chlorinated VOCs, one SVOC, metals, and several water-quality indicators. The following summarizes the findings of the September–October 2008 groundwater sampling and analyses:
 - Groundwater flow in the upper, intermediate, and lower surficial-aquifer zones was generally northeast toward Frog Mortar Creek. However, local variations in the hydrology of the intermediate and lower surficial-aquifer zones cause divergent flow north towards the MANG property and south towards the southern end of the MSA peninsula.
 - Concentrations of chlorinated VOCs exceed Maryland groundwater standards throughout a large portion of the investigation area and at multiple depths. The maximum TCE concentration observed in a then-current monitoring well sample was 29,000 µg/L, reported for upper surficial-aquifer well DMW11S. Multiple VOC sources at the site result in VOC-contaminated groundwater extending to areas north

of Pond #2, south to DMW6I and DMW7I, and west to the area between Taxiway Tango and the runway.

- Chlorinated VOCs were detected at concentrations exceeding Maryland groundwater standards in samples from monitoring wells then-recently installed north and east of Pond #2 and south of pre-existing groundwater monitoring wells.
- Concentrations of chlorinated VOCs in groundwater decreased substantially as compared to the 2004 chemical results for the MSA. The TCE-concentration reduction for 2008 and high concentrations of the chemical daughter-products cis-1,2-DCE, VC, and chloroform indicate that TCE degradation is occurring at the site.
- VOC contamination was not fully delineated north–northwest of well clusters MW14, MW17, and MW28; east of well clusters MW14, MW18, DMW3, DMW2, DMW4, and DMW5; west of DMW11S; and south of well clusters MW19 and MW24.
- 1,4-Dioxane was detected primarily in groundwater samples from the upper and intermediate surficial-aquifer zones. 1,4-Dioxane was co-located in areas containing the highest concentrations of chlorinated VOCs, occurring primarily near Pond #1 and the area east of Pond #1. The highest concentrations of 1,4-dioxane was 590 µg/L at well MW16S (located northwest of Pond #2) and 490 µg/L at well DMW2A (located east of Pond #1 near Frog Mortar Creek).
- Concentrations of 12 metals exceed groundwater standards in one or more groundwater samples. Concentrations of manganese and iron most frequently exceed the standards (89% and 79% of samples, respectively), with the maximum concentrations exceeding the standards by more than a factor of 100. Concentrations of cadmium exceed the standard in 20% of samples, with the maximum concentration exceeding the groundwater standard by more than two orders of magnitude. The greatest concentrations of cadmium are associated with high levels of VOCs in the intermediate surficial-aquifer at groundwater monitoring wells DMW1A, DMW2A, DMW8I, and DMW3-I, located south and east of Pond #1. Concentrations of metals such as chromium, hexavalent chromium, lead, mercury, and zinc exceeded the standards in less than 10% of the samples, ranging from one exceedance each for mercury and zinc to five exceedances for lead. Dissolved lead and mercury concentrations did not exceed the standards.
- **Additional Well Installation—2009:** In August 2009, three new two-level well clusters (MW32S/I, MW33S/I, and MW34S/I) were installed at the Dump Road site. These monitoring wells were installed to further characterize the horizontal and vertical extent of groundwater contamination in the northern, northwestern, and southern portions of the site where the boundaries of VOC contamination had not been delineated. The installed wells included three upper-zone wells and three intermediate-zone wells. These wells were installed as nested wells in a single borehole. Drilling, well installation, and well development followed procedures discussed previously for the 2007 well-installation program.

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- **August through September 2009: Groundwater Monitoring**— This monitoring was conducted to provide a new round of groundwater data for older existing groundwater monitoring wells and a third round of groundwater data for newly installed monitoring wells at MSA. These data describe then-current groundwater-quality conditions at the facility in order to evaluate time-based groundwater-contaminant trends and to evaluate remedial actions in subsequent studies. Groundwater samples were chemically analyzed for chlorinated VOCs, one SVOC, metals, and several water-quality indicators. The following summarizes the findings of the August through October 2009 groundwater sampling and analyses:
 - Groundwater flow in the upper, intermediate, and lower surficial-aquifer zones is generally northeast toward Frog Mortar Creek. However, local variations in the hydrology of the upper, intermediate, and lower surficial-aquifer zones provide divergent flow north and northwest, and south towards the southern end of the MSA peninsula.
 - Concentrations of chlorinated VOCs exceed Maryland groundwater standards throughout a large portion of the investigation area and at multiple depths. The maximum TCE concentration observed in a then-current monitoring well sample was 36,000 µg/L, reported for upper surficial-aquifer well DMW11S. Multiple VOC sources at the site have resulted in VOC-contaminated groundwater extending to areas north of Pond #2, south to DMW6I and DMW7I, and west to the area between Taxiway Tango and the runway.
 - Chlorinated VOCs were detected at concentrations exceeding Maryland groundwater standards in samples from monitoring wells recently installed northwest of Pond #2. TCE was not detected in two new wells installed south of the Drum Area plume.
 - Concentrations of chlorinated VOCs in groundwater are consistent with the 2008 results and decreased substantially when compared to the 2004 chemical results for the MSA. The TCE-concentration reduction for 2009 and the high concentrations of the chemical daughter-products cis-1,2-DCE, VC, and chloroform indicate that TCE degradation is occurring at the site.
 - VOC contamination has not been fully delineated west and northwest of well MW15 and MW33; north of well clusters MW14 and MW17; east of well clusters MW14, MW18, DMW3, DMW2, DMW4, and DMW5; and west of DMW11S.
 - 1,4-Dioxane was detected primarily in groundwater samples collected from the upper and intermediate surficial-aquifer zones. 1,4-Dioxane is co-located in areas containing the highest concentrations of chlorinated VOCs, occurring primarily near Pond #1 and the area east of Pond #1. The highest concentrations of 1,4-dioxane were 1,100 µg/L at well DMW3I (east of Pond #1 near Frog Mortar Creek) and 790 µg/L at well MW16S (north of Pond #2).
 - Concentrations of 11 metals exceeded groundwater standards in one or more groundwater samples. Concentrations of manganese and iron exceeded the standards most frequently, with the maximum concentrations exceeding the standards by more

than a factor of 100. Concentrations of cadmium exceeded the standard in nearly 20% of samples, with the maximum concentration exceeding the groundwater standard by more than two orders of magnitude. Concentrations of metals such as chromium, lead, mercury, and selenium exceeded the standards in less than 10% of the samples, ranging from one exceedance for selenium to three exceedances for lead. Dissolved lead and mercury concentrations did not exceed standards.

- **2010 Remedial Investigation Report**—A remedial investigation (RI) was completed in early 2010 (Tetra Tech, 2010b) and included an evaluation of the nature and extent of soil and groundwater contamination, assessing the fate and transport of contaminants in soil and groundwater, and presenting a human health risk assessment (HHRA) and an ecological risk assessment (ERA). The RI was based on physical and chemical data for soil collected from 2000–2009, and groundwater chemical data from 2007–2009. Below is a summary of the RI's findings:
 - Chemical analyses of numerous soil samples and several pond sediment samples indicated VOCs, SVOCs, polychlorinated biphenyls (PCBs), and several metals in soil and pond-bottom sediment at concentrations exceeding USEPA human health and ecological risk-based screening levels and MDE soil-cleanup standards. The primary VOCs detected in soil and pond sediment samples were TCE, TCE degradation products (such as cis-1,2-DCE and VC), and benzene, toluene, ethylbenzene, and xylenes (BTEX). SVOCs detected in soil and sediment included polynuclear aromatic hydrocarbons (PAHs). A subset of the 19 metals detected in soil and pond sediment at the site included antimony, arsenic, cadmium, copper, chromium, lead, mercury, nickel, and zinc.
 - Groundwater samples collected in 2007–2009 were analyzed for VOCs, 1,4-dioxane, perchlorate, total and dissolved metals, and hexavalent chromium. Upper surficial aquifer wells were analyzed in 2009 for TPH-DRO and TPH-GRO. Selected wells were analyzed for Natural Attenuation Assessment (NAA) parameters such as alkalinity, chemical oxygen demand, dissolved gasses (methane, ethane, ethene, hydrogen, oxygen, carbon dioxide), anions, total organic carbon, etc. Approximately 200 groundwater samples were collected between 2007 and 2009 for the upper, intermediate and lower surficial aquifer, and deep confined aquifer.
 - Concentrations of cVOCs (such as TCE and cis-1,2-DCE) exceeded federal and Maryland groundwater standards throughout a large portion of the investigation area and at multiple depths. Multiple VOC sources at the site have resulted in VOC-contaminated groundwater extending west to the airport runway, north to well MW34 (north of Pond 2), east near the Frog Mortar Creek shoreline at wells MW14-DMW5, and south to well MW24.
 - Concentrations of cVOCs in groundwater generally decreased as compared to the 2004 chemical results for the MSA. The reductions of TCE concentrations and the high concentrations of the chemical daughter products cis-1,2-DCE, VC, and ethene indicate that TCE degradation occurred at the site and may continue.

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- 1,4-Dioxane was detected primarily in groundwater samples from the upper and intermediate surficial aquifer zones. 1,4-Dioxane is generally co-located in areas containing the highest concentrations of cVOCs, occurring primarily near Pond 1 and the area east.
 - Concentrations of cadmium exceeded the standard in 20% of the samples. The greatest concentrations of cadmium were associated with high levels of VOCs in the intermediate surficial aquifer at wells DMW1A, DMW2A, DMW8I, and DMW3I, south and east of Pond 1.
 - BTEX was detected less frequently and at lower concentrations with respect to groundwater standards than were the chlorinated aromatic hydrocarbons. Well DMW9S, near the Petroleum Hydrocarbon Area, had the greatest concentrations of BTEX.
 - In 2009, groundwater samples from the upper surficial aquifer were analyzed for TPH-DRO which was detected in more than half of the samples, with the greatest concentration reported for well DMW20S in the upper surficial aquifer south of the Petroleum Hydrocarbon Area. TPH-GRO was detected in nearly all of the samples, with the greatest concentration reported for well DMW9S in the upper surficial aquifer south of the Petroleum Hydrocarbon Area. Substantially lower concentrations of TPH-DRO and TPH-GRO were reported for wells at the Drum Area Plume and Taxiway Tango Plume area.
 - Groundwater modeling supported development of remedial alternatives to address VOCs and 1,4-dioxane contamination in groundwater. These remedial alternatives focus on controlling and capturing contaminated groundwater at the site. Additional simulations examined the effects of placing injection and extraction wells in the plumes' high concentration zones.
 - An HHRA produced in accordance with USEPA and MDE guidelines evaluated risk to potential human receptors under current and likely future land uses. The HHRA considered receptor exposure under non-residential (e.g., industrial, recreational) and residential land use scenarios. The predominant human health chemicals of potential concern (COPCs) for direct contact exposure are reported as cVOCs (soils, groundwater, sediments), BTEX (soils, groundwater), substituted benzene compounds (soils, groundwater), PAHs (soils, sediments), and several heavy metals (e.g., cadmium, lead, copper, chromium, nickel). Only one chemical was detected in surface water, and no COPCs were selected for surface water. Risks due to trespasser exposures to surface water were not quantitatively evaluated in this HHRA. Groundwater is not currently used as a source of potable or industrial water at the site, nor is such use likely in the future. The groundwater user survey also indicated the possibility of wells near MSA, but these wells, if they exist, would be up gradient of MSA.
 - An ERA produced in accordance with USEPA guidelines evaluated risk to potential ecological receptors in surface soil, sediment, and groundwater (evaluated as surface water). The central area of the site northwest of Pond 1 appears to be the area of largest ecological risk, based on current sampling data. Surface soil ecological

COPCs for invertebrates and plants include TCE, cis-1,2-DCE, antimony, chromium, copper, manganese, molybdenum, and zinc. PAHs are COPCs only for soil invertebrates, whereas cadmium, lead, nickel, and selenium were considered COPCs only for plants. VOCs, PAHs, PCBs, and several metals were considered COPCs for Pond 1 sediment. Evaluation of surface soil identified several metals (mercury, cadmium, lead, and molybdenum) as risks to wildlife (e.g., quails, shrews, robins).

- **2010 Off-site Piezometer Installation**—In March 2010, six off-site piezometers were installed on two privately owned properties—Conrad’s Ruth Villa and Parkside Marina—on the Bowleys Quarters peninsula, east of the Dump Road Area and on the eastern shoreline of Frog Mortar Creek (Tetra Tech, 2010c). Groundwater levels in the six piezometers and three Dump Road wells and creek levels in Frog Mortar Creek were monitored and recorded for one month to better understand off-site groundwater characteristics, including the extent to which the surficial aquifer at those monitoring points is tidally influenced, the presence of vertical hydraulic gradients, and their relationship to the Dump Road Area groundwater characteristics. These data were used to model Dump Road Area groundwater. The following summarizes the off-site piezometer investigation:
 - The piezometers were screened at depths of approximately five- to 15-feet (shallow zone), 29–39 feet (intermediate zone) and 42–52 or 46–56 feet (deep zone) below grade. Screened intervals for the piezometers were set at elevations nearly equivalent to wells installed in the eastern portion of the Dump Road Area. Piezometer locations and casing elevations were surveyed by a Maryland-licensed surveying firm.
 - The six newly installed piezometers and three Dump Road Area wells (DMW4S, DMW4I, and DMW4D) were fitted with electronic water-level data loggers capable of measuring, recording, and storing water-level data. A data logger was also placed in a locked, perforated, steel standpipe installed at the adjacent Parkside Marina dock to record creek levels during the same period. A barometric pressure data logger was also installed in well DMW8S at the Dump Road site to record fluctuations during the monitoring period.
 - Groundwater levels, surface-water levels, and barometric pressure were measured and recorded for one month from June 2–4 to July 6, 2010. The study results indicated that groundwater levels in the surficial aquifer are influenced by both tides and barometric pressure.
- **July 2010: Groundwater Monitoring**— This monitoring was conducted to provide a new round of groundwater data for older existing groundwater-monitoring wells and a fourth round of groundwater data for newly installed monitoring wells at MSA. These data describe then-current groundwater-quality conditions at the facility to be used to evaluate time-based groundwater-contaminant trends and to evaluate remedial actions in subsequent studies. Groundwater samples were chemically analyzed for chlorinated VOCs, one SVOC, metals, and several water-quality indicators. The following summarizes the findings of the July 2010 groundwater and surface water sampling and analyses:

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- Groundwater in the upper, intermediate, and lower surficial aquifer zones flows northeast, to Frog Mortar Creek.
 - Concentrations of cVOCs exceeded Maryland groundwater standards throughout a large portion of the investigation area and at multiple depths. The maximum TCE concentration observed in a then-current monitoring well sample was 36,000 µg/L, reported for upper surficial aquifer well DMW11S. Multiple VOC sources at the site have resulted in VOC-contaminated groundwater extending to areas north of Pond 2, south to DMW6I and DMW7I, and west to the area between Taxiway Tango and the airport runway.
 - Concentrations of cVOCs in groundwater were consistent with the 2009 results. Time-series plots of VOCs in source areas and down-gradient locations indicated a general decrease in VOC concentrations since the early 2000s. VOC concentrations in the source area for the Taxiway Tango Median Area plume (DMW11S) remained steady or had increased slightly since 2003.
 - At six wells where groundwater samples were analyzed for natural-attenuation parameters, anaerobic reductive-dechlorination was evidenced by the presence of the TCE-breakdown product cis-1,2-DCE. The presence of VC, methane, ethene, and elevated chloride concentrations indicated that complete dechlorination may have been readily occurring in the upper and intermediate surficial aquifer zones at the Dump Road site. However, lower relative concentrations of VC, methane, ethene, low groundwater pH, and high ORP indicated that slow or incomplete reductive dechlorination of lower-order cVOCs may have been occurring in the lower surficial aquifer zone.
 - VOC groundwater contamination was present at concentrations greater than groundwater standards at then-currently delineated areas to the north (wells MW14I, MW15S/I, MW16S/I, MW17I, and MW28I), east (wells MW14I, MW18I/S, DMW3S/I, DMW4S/I/D, and DMW5S/I), and west (wells MW24I, DMW11S, and MW33S). Additional investigation is proceeding in areas to the north and west.
 - Sampling results for wells DMW6I/D and MW32S/I indicated that the VOC groundwater contamination was bounded along the southern portion of the site.
 - The SVOC 1,4-dioxane was primarily detected in groundwater samples collected from the upper and intermediate surficial aquifer zones. 1,4-Dioxane was co-located in areas containing the highest concentrations of cVOCs, occurring primarily near Pond 1 and the area to the east. The highest concentrations of 1,4-dioxane were located east of Pond 1 near Frog Mortar Creek at wells DMW2A (590 µg/L), DMW3S (480 µg/L), and DMW3I (390 µg/L). 1,4-Dioxane was detected at a concentration of 1.8 µg/L at Frog Mortar Creek surface water sample SW38 located nearest the Dump Road Area. TPH-DRO was detected in 70% of the 2010 upper surficial-aquifer groundwater samples, at concentrations ranging from 78–2,000 µg/L (averaging 473 µg/L). TPH-GRO was detected in slightly more than half (59%) of the 2010 upper surficial-aquifer groundwater samples, at concentrations ranging from 34–55,000 µg/L (averaging 4,349 µg/L). Most DRO and GRO concentrations

exceeded the MDE criterion of 47 µg/L. The greatest concentrations of DRO and GRO were detected in well DMW9S, in the Petroleum Hydrocarbon and Pond 1 Area. Substantially lower concentrations of TPH-DRO and TPH-GRO were reported for groundwater in the Drum Area and Taxiway Tango Median Area.

- Perchlorate and the explosive cyclotrimethylene-trinitramine or royal demolition explosive (RDX) were not detected in the Dump Road site groundwater samples.
- Concentrations of 11 metals exceeded groundwater standards in one or more groundwater samples. Concentrations of iron and manganese exceeded standards most frequently, with the maximum concentrations of these two metals exceeding standards by more than a factor of 100. Concentrations of cadmium exceeded the standard in nearly 20% of the samples, with the maximum concentration of 833 µg/L exceeding the groundwater standard by more than two orders of magnitude. Arsenic, beryllium, nickel, and vanadium concentrations exceeded the standards; the maximum concentration of vanadium is less than two orders of magnitude more than the groundwater standard, and the maximum levels of arsenic and nickel are less than 10 times the standards. Concentrations of metals such as chromium, lead, mercury, and selenium exceeded standards in less than 10% of samples, ranging from four exceedances for chromium to one exceedance each for selenium and mercury. Dissolved lead and mercury concentrations for filtered samples do not exceed the standards.
- Radium-228 and combined radium-226/228 concentrations exceeded the groundwater standard in samples at intermediate and deep surficial-aquifer wells. Radium-228 concentrations exceed the groundwater standard of 5 pCi/L in samples from wells DMW3I (7.53 pCi/L), DMW6I (11.6 pCi/L), and DMW6D (7.82 pCi/L). The combined radium-226/228 concentration in the sample from well DMW3D (6.30 pCi/L) also exceeded the groundwater standard. Combined radium-226/228 concentrations for wells DMW3I, DMW6I, and DMW6D that exceeded the groundwater standard are 8.264, 12.046, and 9.53 pCi/L, respectively. Concentrations of radium-226, radium-228, or combined radium-226/228, do not exceed the groundwater standard in samples collected from the upper surficial-aquifer (MW3, DMW6S, DMW16S), deep confined aquifer (MW27D, and MW29D), or the third well sampled in the intermediate surficial-aquifer (MW-16I).
- Primary groundwater VOC contaminants TCE, cis-1,2-DCE, VC, and 1,4-dioxane were detected in Frog Mortar Creek surface sample SW38, along the Frog Mortar Creek shoreline northeast of the Dump Road VOC plumes. Three other Dump Road Area groundwater VOCs (1,2,4-trichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene) were detected at low concentrations in SW38. These results indicate that VOC-contaminated groundwater from the Dump Road Area discharges to Frog Mortar Creek. However, other site VOCs, such as BTEX, chlorobenzene, and other chlorobenzene isomers were not detected in the Frog Mortar Creek samples. Detected VOC concentrations were less than the ecological surface-water screening criteria, and these contaminants were not detected in samples SW37 and SW39, located north and south, respectively, of the Dump Road site. However, the VC concentration in SW38 exceeded MDE's Ambient Water Quality Criterion (AWQC)

for consumption of organisms. 1,4-Dioxane was detected at a concentration of 1.8 µg/L at Frog Mortar Creek surface water sample SW38 located nearest the Dump Road Area; however, this concentration was less than the human-health screening criteria and state advisories and standards for drinking water.

- Most metals in the three Frog Mortar Creek surface water samples were detected at similar concentrations. However, concentrations of cadmium, chromium, iron, and manganese for SW38 (nearest Dump Road Area) appeared slightly elevated relative to those reported for the other two samples. Concentrations of barium (SW37-SW39), cadmium (SW38 only), and iron (SW37 and SW38 unfiltered samples only) exceeded the ecological screening criteria for surface water.

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Section 3

Investigation Approach and Methodology

This groundwater-sampling plan has been developed in response to previous investigations and as a part of long-term groundwater monitoring at Maryland State Airport (MSA). The overall objective of groundwater characterization is to provide up-to-date groundwater data for selected groundwater monitoring wells in order to better understand the nature and extent of contamination in groundwater, evaluate the time-based trends of on-site groundwater plumes, evaluate the natural attenuation of chemicals of concern in groundwater at MSA, evaluate the interaction between shallow groundwater and Frog Mortar Creek, and update the modeling of shallow groundwater-flow patterns and discharge to Frog Mortar Creek. Field tasks include groundwater monitoring, installation and monitoring of water level recorders, surface water monitoring and sampling and groundwater sampling. Before initiating any field tasks, appropriate Tetra Tech personnel will assure their familiarity with the site-specific health and safety plan (HASP) and respective Safe-Work Permits and the Emergency Response Plan included in the HASP.

Before daily field events, Tetra Tech will conduct a daily mandatory health and safety tailgate meeting. Documentation of pertinent topics and personnel in attendance will be maintained by the Tetra Tech site health and safety officer. Safety requirements are addressed in greater detail in the site-specific Tetra Tech HASP included as Appendix A.

3.1 GROUNDWATER AND SURFACE-WATER SAMPLING

Groundwater samples will be collected from 66 existing groundwater-monitoring wells. This section details the field procedures. Figure 3-1 depicts the locations of monitoring wells at MSA to be sampled as part of this event.

3.1.1 Synoptic Water-Level Measurements

Before sampling, static synoptic water-levels will be obtained from all 90 existing groundwater-monitoring wells using a graduated electronic-sounding water-level meter. The static water level will be determined by lowering the meter's probe into the well until the liquid level-indicator emits an audible tone, indicating the air/water interface. The water level is read from the probe cable and recorded to the nearest 0.01 foot as the depth-to-water with respect to the top of the casing. The water-level measurements will be recorded in the appropriate site-specific field logbook and on a groundwater-level-measurement field form.

During collection of the synoptic water-level measurements, the depth of each monitoring well will also be recorded. In addition, water levels on the two staff gauges in Frog Mortar Creek (located at the Parkside Marina dock and the Marine Police Station) will be recorded. Staff-gauge elevations will be recorded during every groundwater-level measurement event at intervals through each monitoring day. Staff-gauge water elevations will also be recorded when downloading the data recorder.

3.1.2 Installation and Monitoring of Water Level Recorders

In 2010, six off-site groundwater piezometers were installed on the Conrad's Ruth Villa and Parkside Marina properties on the east side of Frog Mortar Creek, as was a stilling well/staff gauge along the Frog Mortar Creek shoreline adjacent to the area where the piezometers are located. Continuous recorders were placed in each of these seven monitoring points, as well as in three monitoring wells at MSA. Continuous monitoring was conducted in each of these monitoring points for a month, providing a history of surface water levels in Frog Mortar Creek and groundwater levels on both sides of Frog Mortar Creek.

These efforts were aimed at understanding the interaction between shallow groundwater and Frog Mortar Creek and to update the modeling of shallow groundwater-flow patterns and discharge to Frog Mortar Creek. This related directly to the design and implementation of remedial actions to effectively capture contaminated groundwater at the MSA site. Analyses and interpretations of observed conditions and data collected are being used in subsequent reports associated with MSA site remediation, including updating the site's groundwater-flow model.

Preliminary assessment of the water-level data from this recent field effort, along with consideration of the results of prior similar monitoring efforts and subsequent data-analysis and groundwater flow modeling, indicate the need for additional recorder-based monitoring. This data collection would complement the program of manual water-level measurements being conducted on a regular interval.

Each off-site piezometer (six total) and selected on-site monitoring well (three total) will be fitted with a water-level data logger capable of recording and storing water-level data for up to two months. To prevent damage to the data logging equipment, all parts will be housed below the ground surface within the well or road box vault. A data logger will also be installed in the staff gauge at the Parkside Marina dock to record the surface water elevations during the same monitoring period. Water-level data will be collected for one month and data will be compiled and evaluated in the annual monitoring report.

3.1.3 Groundwater Sampling and Analysis

Well Purging— Monitoring wells will be purged using low-flow purging techniques before sample collection. Groundwater will be purged with a peristaltic pump fitted with dedicated, disposable Teflon[®]-lined tubing or a submersible pump positioned midway in the length of the well's saturated-screen. During purging, the pumping rate will range between 100-300 milliliters per minute (ml/min) and will be measured constantly using a graduated cylinder. The purge rate will be adjusted but will not go above 300 ml/min, to prevent a water-level drawdown greater than 0.2 feet from the initial static water-level, if possible.

During groundwater purging, water-level-drawdown measurements and groundwater parameters, including pH, temperature, specific conductance, dissolved oxygen (DO), oxygen-reduction potential (ORP), and turbidity will be collected every five to 10 minutes until purging is complete and recorded in the appropriate site-specific logbook, as well as on Low-Flow-Purge Data Sheets. The water-quality parameters will be measured using a Horiba U-22 water-quality meter or a similar inline water-quality meter. Turbidity readings will be collected using a separate turbidity meter.

Purging will be considered complete when the monitored water-quality parameters have stabilized, three saturated well-casing volumes have been removed, the well is purged dry, or for

a 90-minute period, whichever occurs first. Stabilization will be considered achieved when three consecutive readings, taken at five-minute intervals, are within ± 0.1 for pH, $\pm 3\%$ for specific conductance and temperature, $\pm 10\%$ for DO and ORP, and less than 10 nephelometric turbidity units for turbidity. If the monitoring well is purged dry, the water level in the well will be allowed to recover a minimum of 80% of its initial static water level before groundwater sampling. All purged water will be collected in United States Department of Transportation (USDOT)-approved 55-gallon steel drums, as detailed in Section 3.1.

Sample Collection— After purging, monitoring wells will be sampled using the same dedicated tubing or submersible pump as was used during purging. Groundwater samples will be collected using low-flow sampling protocols and collected at the same pumping rate as was used during well purging. Samples will be collected immediately after purging without stopping the pump or changing the pumping rate. The collected water will be pumped directly into the appropriate sample containers or into a certified-clean disposable container (supplied by the laboratory), which will then be used to directly pour the collected water into the appropriate sample containers. Samples collected for hexavalent chromium analysis will be collected in the afternoon and not on Fridays or holidays, to minimize sample-holding time before analysis.

Laboratory Analyses— We propose the following laboratory analyses:

- VOCs, plus “Tentatively Identified Compounds” (TICs), Freon 22 (Chlorodifluoromethane), and Freon 113, by USEPA Method 8260B— 66 existing monitoring wells
- 1,4-Dioxane, by the USEPA Method 8270C SIM— 66 existing monitoring wells
- Perchlorate, by USEPA SW846 Method 314— 66 existing monitoring wells
- Mercury, by USEPA SW846 Method 7470A— 66 existing monitoring wells
- Hexavalent chromium, by the USEPA Method 7199— 66 existing monitoring wells
- Total and dissolved priority-pollutant metals, by USEPA Method 6020B— 66 existing monitoring wells
- Radium 224, 226, and 228, by USEPA 900 series methods— 11 existing groundwater monitoring wells up gradient and down gradient of the Dump Road Area in the upper, intermediate and lower surficial aquifers

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- Haloacetic acids, by USEPA Method 552.1, .2, .3, or .4— 3 existing groundwater monitoring wells in the upper surficial aquifer within the chlorinated solvent plume
 - RDX (cyclonite), by USEPA Method 8330A— 10 existing groundwater monitoring wells in the upper surficial aquifer
 - Gasoline-range organic and diesel-range organics, by SW846 Method 8015B— 26 shallow monitoring-wells screened in the upper surficial-aquifer
 - NAA parameters— Six monitoring wells will be analyzed using USEPA SW846 protocols for NAA parameters (nitrate, nitrite, ammonia nitrogen, phosphate, sulfate, total alkalinity, dissolved organic carbon, total iron, total manganese, total potassium, total calcium, total magnesium, total chloride, total sodium, total silica, and total dissolved solids [TDS]). Methane and ethane will be analyzed using Microseeps® AM 20GAX protocols. Ferrous iron will be field-tested for using Hach test kits.

No duplicates will be collected during this investigation. An estimated 14 trip-blank samples (one per-cooler per-day of sampling) will be collected for VOC analysis for quality assurance, quality control (QA/QC) purposes. Matrix spike and matrix-spike duplicate samples will be collected on a 1:20 basis. All analyses will be turned around in 21 business days. Monitoring well locations to be sampled and associated analytes are detailed in Table 3-1.

3.1.4 Surface-Water Sampling and Analysis

Based on a review of the prior surface-water sampling of Frog Mortar Creek in May 2010, we concluded that additional investigation of Frog Mortar Creek was necessary to determine if groundwater discharge from the Dump Road area into Frog Mortar Creek exceeds Environmental Protection Agency (EPA) or MDE screening levels or water quality criteria. Three surface water sample locations were sampled in July 2010 adjacent to the Dump Road Area - one near the northern limit of the dump area, one near the center of the impacted groundwater area and one near the southern limit.

The July 2010 surface-water samples were collected manually from near the shore, approximately one-foot below the water surface, and were analyzed for volatile organic compounds (VOC)s, polycyclic aromatic hydrocarbons (PAH)s, metals (filtered and unfiltered), perchlorate, 1,4-dioxane and hexavalent chromium. The results of the July 2010 surface water sampling showed the presence of site-groundwater-contaminants trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), vinyl chloride (VC) and 1,4-dioxane in surface sample SW38, indicating the need for additional sampling. Consequently, three surface-water sampling

events will be conducted in 2011: the first event will be conducted in February, the second in April and the third in June 2011. A total of five Frog Mortar Creek surface-water samples will be collected during the February and April sampling events. Three of the surface water samples from each event will be collected at the same locations, (SW-37, SW38 and SW39), as sampled in July 2010; the two remaining samples will be collected approximately 300 feet northwest (SW-40) and 300 feet southeast (SW-41) of the location of sample location SW38. Sampling locations are shown on Figure 3-2.

During the June 2011 surface-sampling event, three Frog Mortar Creek surface water samples will be collected from the three central sample locations: one near the center of the affected groundwater area (SW38), one approximately 300 feet northwest (SW-40), and one 300 feet southeast (SW-41). During sample collection, the surface-water sampling locations will be surveyed using a hand-held global positioning system (GPS) receiver. Sampling locations will be surveyed in the Maryland State Plane North American Datum (NAD) 1983 (feet).

Surface-water samples will be collected as grab samples using direct-filling sampling techniques. All samples will be collected at near-shore locations at a depth of approximately 1-foot below the water surface. A pre-cleaned, unpreserved bottle will be submerged approximately one-foot below the water surface and allowed to fill. The collected sample volume will then be decanted into the appropriate sample containers, taking care to minimize agitation of the collected water. A peristaltic pump fitted with a 0.45-micron inline filter will collect a filtered surface-water sample for dissolved-metals analysis. All reusable equipment will be decontaminated between sampling locations, as described in Section 3.1.7.

The three surface-water samples collected during each sampling event from adjacent to the Dump Road Area plume (SW-38, SW-40 and SW-41) will be analyzed for the following parameters: VOCs by SW846 Method 8260B; PAHs, 1,4-dioxane by SW846 Method 8270C; Priority Pollutant Metals (filtered and unfiltered) by SW846 Method 6020B; Hexavalent Chromium by SW846 Method 7199; and Perchlorate by EPA Method 314.

The two surface-water samples collected during the February 2011 and April 2011 sampling events from the locations northwest and southeast of the Dump Road Area (SW-37 and SW-39) will be analyzed for the following parameters only: Priority Pollutant Metals (filtered and

unfiltered) by SW846 Method 6020B; and Hexavalent Chromium by SW846 Method 7199. Analytical parameters are presented in Table 3-2.

No duplicates will be collected during this investigation. It is estimated that one trip-blank sample per sampling event (one per-cooler per-day of sampling) will be collected for VOC analysis for QA/QC purposes. Matrix-spike and matrix-spike-duplicate samples will be collected on a 1:20 basis. All analysis will be turned around in 21 business days. Surface-water quality parameters, including temperature, pH, specific conductance, turbidity, dissolved oxygen, and oxidation-reduction potential will be collected from each surface-water sampling location. The total water depth at the sample location and the stage of the tide will be recorded at the time of sampling. All information will be documented on a surface-water sample form.

3.1.5 Documentation

A master site-logbook will be maintained as an overall record of field activities. Sample documentation will comprise completed chain-of-custody forms and matrix-specific sample log-sheets. The chain-of-custody forms are standardized to summarize and document pertinent sample information such as sample identification and type, matrix, date and time of collection, preservation, and requested analysis. Sample-custody procedures are designed to document sample acquisition and integrity.

3.1.6 Sample Nomenclature and Handling

Each groundwater and surface-water sample collected during the characterization study will be identified with a unique sample-identification tag. The sample-identification tag will consist of the site location, the well number, and a six-digit sampling date. For example, a groundwater sample collected on June 15, 2011 from monitoring well MSA-DMW2S would be labeled as MSA-DMW2S-061511. Surface-water samples will be labeled with an “SW” prefix followed by the sample number and six-digit sampling date. Trip blanks will be labeled with a “TB” prefix followed by the blank’s six-digit submittal date (e.g., TB-091510).

Sample handling includes field-related considerations concerning the selection of sample containers, preservatives, allowable holding times, and analyses requested. Proper custody procedures will be followed throughout all phases of sample collection and handling. Chain-of-custody protocols will be used throughout sample handling to establish the evidentiary

integrity of sample containers. These protocols will demonstrate that the samples were handled and transferred in a manner that would prevent or detect possible tampering. Sample containers will be released under signature from the laboratory and will be accepted under signature by the sampler(s) or responsible individual that maintains custody until the sample containers are transferred to the sampler(s). Transport containers returning to the laboratory will be sealed with strapping tape and a tamper-proof custody seal. The custody seal includes the signature of the individual releasing the transport container, along with the date and time.

3.1.7 Equipment Decontamination

Dedicated as well as disposable equipment will be used for groundwater purging and surface-water and groundwater sampling, so decontamination activities for surface-water and groundwater sampling will be minimal. Reusable equipment such as pumps and water-level meters will be decontaminated before and after each use. Decontamination for reusable equipment will consist of the following activities/procedures:

- Alconox and potable water wash
- Potable water rinse
- Reagent-grade isopropanol rinse (the equipment is thoroughly wetted with isopropanol)
- Analyte-free water rinse
- Air drying
- Decontamination solutions will be containerized for disposal

3.1.8 Waste Management

Investigation-derived waste (IDW) consisting of decontamination rinsate water, purge water, and personal protective equipment (PPE) will be generated during the groundwater characterization study. PPE IDW will be brushed off, placed in trash bags, and disposed of in a facility trash receptacle designated by Lockheed Martin personnel. Purge water will be collected and stored in USDOT-approved 55-gallon steel drums. All drums will be appropriately labeled and logged on a drum-inventory form. The waste will be characterized and disposed in accordance with applicable state and federal regulations. After waste generation, drums will be relocated to a drum-staging area identified by Lockheed Martin personnel.

Samples of the IDW will be collected and submitted for waste profiling. Upon receipt of the IDW analytical data, the generated IDW will be removed from the facility and properly disposed in accordance with federal, state, and local regulations. A Waste Management Plan conforming to Lockheed Martin Energy, Environment, Safety, and Health (EESH) Remediation Waste Management Procedure No. EROP-03, Revision 4, effective April 17, 2009 is included as Appendix B.

3.2 DATA MANAGEMENT

Data-handling procedures to be followed by the laboratory will meet the requirements of the laboratory subcontract. All analytical and field data will be maintained in the project files. The project files will contain copies of the chain-of-custody forms, sample-log forms, sampling-location maps, and documentation of quality assurance and data manipulation.

3.2.1 Data Tracking and Control

A “cradle-to-grave” sample-tracking system will be used from the beginning to the end of the sampling event. Before field mobilization, the field operations leader (FOL) will coordinate/initiate sample tracking. Sample-jar labels will be handwritten in the field. The labels will be reviewed for adherence to work plan requirements and accuracy. The project manager (PM) will coordinate with the analytical laboratory to ensure that the laboratory is aware of the number and type of samples and analyses.

When field sampling is underway, the FOL will forward the chain-of-custody forms to the PM or their designee and the laboratory for each day that samples are collected. The PM or their designee will confirm that the chain-of-custody forms provide the information required by the work plan. This will allow for early detection of field errors so that adjustments can be made while the field team is in place.

After successful completion of all requested analyses, the laboratory will submit an electronic deliverable for every sample-delivery group (SDG). When all electronic deliverables have been received from the laboratory, the PM or their designee will ensure that the laboratory has performed all requested analyses. Discrepancies will be noted early enough so that all samples can be analyzed within the prescribed holding times.

3.2.2 Sample Information

Data from field measurements will be recorded using appropriate log sheets. Reduction of field data entails the summarization and presentation of these data in tabular form. The reduction of laboratory data entails manipulation of raw-data instrument-output into reportable results. The FOL will verify field data (e.g., temperature readings) daily. Laboratory data will be verified by the group supervisor and then by the laboratory's Quality Control/Documentation Department.

3.2.3 Project Data Compilation

The analytical laboratory will generate a PDF file of the analytical-data packages, as well as electronic-database deliverables. The electronic database will be checked against the PDF file provided by the laboratory and updated as required, based on data-qualifier flags applied during data validation. Data generated during groundwater monitoring will be incorporated into the Environmental Geographic Information System (EGIS) database. All data, such as units of measure and chemical nomenclature, will be manipulated to maintain consistency with the project database.

3.2.4 Geographical Information System (GIS)

Data management systems consist of a relational database and GIS used to manage environmental information pertaining to MSA. The relational database stores chemical, geological, hydrogeologic, and other environmental data collected during environmental investigations. The GIS is developed from the relational database and contains subsets of the larger data pool. The GIS allows environmental data to be posted on base maps to present the information graphically. Upon compilation of sample, chemical, and positional data, the data will be compiled and incorporated into the EGIS.

3.3 DATA REVIEW

Data received from the laboratory will be entered into a sample database and evaluated against risk-based criteria. Data validation, consisting of data completeness, holding time, calibrations, laboratory and field blank contamination, field-duplicate precision, and detection limits, will be completed concurrent with the data evaluation. Data from this sampling event will consist of surface-water and groundwater samples intended to better understand the nature and extent of groundwater and surface-water contamination, to evaluate any changes in the on-site

groundwater plumes, and to evaluate the natural attenuation of the chemicals of concern in groundwater.

TABLE 3-1

GROUNDWATER LABORATORY ANALYTICAL SAMPLING PROTOCOL
MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND
PAGE 1 OF 2

Monitoring Well	Analytical Requirements										
	VOCs (TICs, Freon 22, Freon 112)	1,4-Dioxane	Perchlorate	Total PPM	Dissolved PPM	Mercury	GRO and DRO	Radium 224, 226, and 228	Haloacetic Acids	Natural Attenuation Parameters	RDX
	(EPA 8260B)	(EPA 8270C SIM)	(EPA 314)	(EPA 6020B)	(EPA 6020B)	(EPA 8260)	(EPA 8015B)	(EPA 900 Series)	(EPA 552.1, .2, .3, or .4)	(see below)	(EPA 8330A)
	3x40ml vials w/HCL	2 liters Amber	250ml plastic	500mL w/HNO3	500mL filtered w/HNO3	See Metals	2x40ml vials w/HCL & 2 liters Amber	(Different labs) 2 liters plastic w/HNO3	(Different lab) 2x250ml amber	(see below)	(see below)
Upper Surficial-Aquifer											
MW3	X	X	X	X	X	X	X	X			
MW4	X	X	X	X	X	X	X				
MW5	X	X	X	X	X	X	X				
MW6	X	X	X	X	X	X	X				
DMW1S	X	X	X	X	X	X	X				
DMW2S	X	X	X	X	X	X	X		X		
DMW3S	X	X	X	X	X	X	X		X		
DMW4S	X	X	X	X	X	X	X				
DMW5S	X	X	X	X	X	X	X		X		
DMW6S	X	X	X	X	X	X	X	X			
DMW8S	X	X	X	X	X	X	X				
DMW9S	X	X	X	X	X	X	X			X	X
MW10S	X	X	X	X	X	X	X			X	X
MW11S	X	X	X	X	X	X	X			X	X
MW15S	X	X	X	X	X	X	X				
MW16S	X	X	X	X	X	X	X	X			
MW17S	X	X	X	X	X	X	X				
MW18S	X	X	X	X	X	X	X			X	X
MW20S	X	X	X	X	X	X	X				
MW23S	X	X	X	X	X	X	X				
MW24S	X	X	X	X	X	X	X				
MW25S	X	X	X	X	X	X	X				
MW26S	X	X	X	X	X	X	X				
MW32S	X	X	X	X	X	X	X				
MW33S	X	X	X	X	X	X	X				
MW34S	X	X	X	X	X	X	X				
Intermediate Surficial-Aquifer											
DMW1A	X	X	X	X	X	X					
DMW2A	X	X	X	X	X	X					
DMW3I	X	X	X	X	X	X		X			
DMW4I	X	X	X	X	X	X					
DMW5I	X	X	X	X	X	X					
DMW6I	X	X	X	X	X	X		X			
DMW8I	X	X	X	X	X	X					
DMW9I	X	X	X	X	X	X				X	X
MW11I	X	X	X	X	X	X					
DMW14I	X	X	X	X	X	X					
MW15I	X	X	X	X	X	X					
MW16I	X	X	X	X	X	X		X			
MW17I	X	X	X	X	X	X					
MW18I	X	X	X	X	X	X				X	X
MW19I	X	X	X	X	X	X					
MW20I	X	X	X	X	X	X					

TABLE 3-1

GROUNDWATER LABORATORY ANALYTICAL SAMPLING PROTOCOL
MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND
PAGE 2 OF 2

	Analytical Requirements										
	VOCs (TICs, Freon 22, Freon 112)	1,4-Dioxane	Perchlorate	Total PPM	Dissolved PPM	Mercury	GRO and DRO	Radium 224, 226, and 228	Haloacetic Acids	Natural Attenuation Parameters	RDX
	(EPA 8260B)	(EPA 8270C SIM)	(EPA 314)	(EPA 6020B)	(EPA 6020B)	(EPA 8260)	(EPA 8015B)	(EPA 900 Series)	(EPA 552.1, .2, .3, or .4)	(see below)	(EPA 8330A)
MW24I	X	X	X	X	X	X					
MW25I	X	X	X	X	X	X					
MW28I	X	X	X	X	X	X					
MW32I	X	X	X	X	X	X					
MW33I	X	X	X	X	X	X					
MW34I	X	X	X	X	X	X					
Lower Surficial-Aquifer											
DMW1B	X	X	X	X	X	X					
DMW3D	X	X	X	X	X	X		X			
DMW4D	X	X	X	X	X	X					
DMW6D	X	X	X	X	X	X		X			
DMW8D	X	X	X	X	X	X					
DMW9D	X	X	X	X	X	X				X	X
MW14D	X	X	X	X	X	X					
MW15D	X	X	X	X	X	X					
MW16D	X	X	X	X	X	X		X			
MW19D	X	X	X	X	X	X					
MW20D	X	X	X	X	X	X					
MW22D	X	X	X	X	X	X					
MW23D	X	X	X	X	X	X					
Deep Wells											
MW27D	X	X	X	X	X	X		X			
MW29D	X	X	X	X	X	X		X			
MW30D	X	X	X	X	X	X					
MW31D	X	X	X	X	X	X					

VOCs - Volatile Organic Compounds

PPM - Priority Pollutant Metals

Natural Attenuation Parameters: nitrate, nitrite, ammonium nitrogen, phosphate, sulfate, total alkalinity, dissolved organic carbon, total iron, total calcium, total manganese, total potassium, total manesium, total chloride, total silica, and total dissolved soilds (EPA SW846).

Methane, ethane, and ethene (Microseeps © AM 20GAX).

Dissolved Gases - 2x40mL vial with HCl

DOC - 2x40mL vial with H2SO4

Ammonia - 250mL plastic with H2SO4

ALK.,TDS+ANIONS - 1 liter plastic

Wells not Sampled:

RW1S	MW23I
OW1S	MW26I
MW2	DMW2B
DMW7I ⁽¹⁾	DMW5D
MW10I	DMW7D
MW21I	MW17D
MW22I	MW18D ⁽¹⁾

TABLE 3-2

**SURFACE WATER ANALYTICAL SAMPLING PROTOCOL
MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND**

Surface Water	Analytical Requirements					
	VOCs	PAHs and 1,4-Dioxane	Perchlorate	Total PPM	Dissolved PPM	Hexavalent Chromium
Location	(EPA 8260B)	(EPA 8270C SIM)	(EPA 314)	(EPA 6020B)	(6020B/7470a)	(EPA 218.6)
	3x40ml vials w/HCL	2 liters Amber	250ml plastic	500mL w/HNO3	w/HNO3	250mL plastic
MSA-SW37				X	X	X
MSA-SW38	X	X	X	X	X	X
MSA-SW39				X	X	X
MSA-SW40	X	X	X	X	X	X
MSA-SW41	X	X	X	X	X	X

VOCs - volatile organic compounds

PPM - priority pollutant metals

HCL - hydrochloric acid

HNO₃ - nitric acid





Section 4

Project Deliverables

An Annual Groundwater Monitoring Report summarizing the results of the groundwater and surface-water investigations will be prepared and will include a technical evaluation of the investigation program, groundwater potentiometric-surface maps, concentrations of chemicals detected, staff-gauge and water-level recorder results, and laboratory analytical reports. Once the analytical data have been obtained from the laboratory, the data will be validated for all of the analyses. Results reported for the sampling event will be included in a report with summary tables. The report will include at a minimum: a summary and description of activities performed, including field procedures and monitoring wells sampled; figures illustrating sampling locations, the extent of contaminant plumes, and groundwater-elevation maps for the upper, middle, and lower zones; a laboratory report; summary tables of laboratory analytical results, field measurements, and groundwater elevations; documentation of the data validation and data-usability assessment; a summary of monitoring-well status with recommendations for possible repairs or improvements; documentation of waste handling and disposal; and other relevant documentation. Recommendations regarding the subsequent rounds of groundwater monitoring, including monitoring wells to be sampled and analyses to be performed, will also be provided.

Data obtained during the installation of the water level recorders will be evaluated and presented to improve the understanding of the hydrogeologic conditions in the Frog Mortar Creek area, including groundwater flow patterns east of Frog Mortar Creek. The reporting will include a map depicting piezometer locations, phased plots of the water-level data, and cross-sectional schematic depictions of vertical-head differences that prevail at the piezometer locations. Water-level data will be adjusted for atmospheric-pressure fluctuations, as needed, depending on whether a vented or non-vented recorder was used. The geologic layers' hydraulic responses will be analyzed based on tidal influences identified by water-level recorder data from the Dump Road Area. The results will be compared to prior analysis and used to help compare groundwater flow conditions on either side of Frog Mortar Creek. Data will be corrected according to

manufacturer recommendations and procedures, and external influences will be appropriately accounted for to develop a final plot of water-levels over time. This work will conform to prior water-level data processing for the MSA groundwater modeling. A draft technical memorandum report will be submitted to Lockheed Martin for review and comment after completion of both surface-water sampling and analysis. After receipt of comments from Lockheed Martin, a final technical memorandum report will be generated. Surface-water sampling will also be included as part of this 2011 annual groundwater and surface water monitoring report.

Section 5

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APPENDIX A — HEALTH AND SAFETY PLAN

Waste Management Plan Martin State Airport and Satellite Sites 701 Wilson Point Road Middle River, Maryland

Prepared for:

Lockheed Martin Corporation

Prepared by:

Tetra Tech, Inc.

January 2011



Michael Martin, P.G.
Regional Manager

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APPENDICES

Appendix A— Waste Identification and Classification Form

Appendix B— Hazardous Waste Manifest Signature-Authorization Form

Appendix C— Hazardous Material/Waste Shipment-Checklist

Appendix D— Drum Inventory Form

Appendix E— Site Contact Sheet

**Appendix F— EESH Remediation Operating Procedure No: EROP-03,
“EESH Remediation Waste Management”**

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ACRONYMS

CFR	<i>Code of Federal Regulations</i>
HAZWOPER	hazardous waste operations
IDW	investigation-derived waste
LMCPI	LMC Properties, Inc.
Lockheed Martin	Lockheed Martin Corporation
MDOT	Maryland Department of Transportation
MSA	Martin State Airport
OSHA	(federal) Occupational Safety and Health Administration
PPE	personal protective equipment
Tetra Tech	Tetra Tech, Inc.
TSD	treatment, storage, and disposal
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency

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Section1

Purpose

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. (Tetra Tech) has prepared this *Waste Management Plan* due to the potentially contaminated nature of the waste that will be generated as part of the field investigations conducted at the Martin State Airport (MSA) Dump Road and Strawberry Point locations and adjacent creeks (Figure 1-1). Waste materials that will be generated will be both solid and liquid and will be handled as investigation derived waste (IDW). Following proper IDW procedures, the IDW generated will be collected in U.S. Department of Transportation approved steel drums, stored at a facility designated location (considered a temporary, satellite accumulation area), sampled for waste profiling and characterization and, once characterized, disposed of off-site at a Lockheed Martin approved facility. IDW generated during MSA field investigations will include, but is not limited to, soil, sediment, and water (surface, groundwater, purge and/or decontamination water).

A Tetra Tech geologist will be on-site for all field activities performed by Lockheed Martin at MSA. All work conducted by a subcontractor will be performed under the direction of the Tetra Tech geologist and in full compliance with the Maryland Department of Transportation (DOT), and other local, state, and federal regulations, including the federal Resource Conservation and Recovery Act, Toxic Substances Control Act, Occupational Safety and Health Administration (OSHA) 1910.120, and Lockheed Martin's EROP-03. IDW will be handled in accordance with the U.S. Environmental Protection Agency (USEPA) guidance *Management of Investigation Derived Wastes During Site Inspections*, OERR Directive 9345.3-02, May 1991. This plan is organized as follows:

Section 2—Responsibilities and Training Requirements: Presents the requirements and responsibilities of Tetra Tech and the appointed subcontractor

Section 3—Hazardous Waste Determinations: Briefly describes how the determination of waste characterization is completed

Section 4—Shipping Requirements: Pre-shipment, shipping, and post-shipment requirements

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Figure 1-1
Site Location Map

The map shows the location of the site in Maryland. An inset map of Maryland highlights the location of Middle River. The main map shows the Martin State Airport, Kingston Point Park, Stansbury Estates, and Strawberry Point. Key roads include Middle River Blvd, 4 Lane, and Dump Road. Water bodies include Middle River, Kingston Ch, and Stansbury Creek. Other landmarks include a Drive-in Theater, Frog Mortar, and a Sandpit. The map also shows various roads like Edithorne Rd, Southorne Rd, and Shore Rd. The site is marked with a red star, and Strawberry Point is marked with a yellow star. A blue star marks a location near the Sandpit. A north arrow is present in the top right corner.

Section 2

Responsibilities and Training Requirements

Training complying with all state and federal protocols is required for all Tetra Tech personnel and subcontractors. All personnel will complete appropriate federal Occupational Safety and Health Administration (OSHA) hazardous waste operations (HAZWOPER) training and annual refresher training as specified in *29 Code of Federal Regulations (CFR) §1910.120*. All subcontractor-training certifications shall be provided electronically to the Lockheed Martin project lead. Tetra Tech personnel certificates are maintained internally and can be provided to Lockheed Martin upon request.

U.S. Department of Transportation (USDOT) HAZMAT employee training is required for anyone involved in preparing hazardous waste for shipment and offering hazardous waste for transport and transportation, including signing of hazardous waste manifests (see 49 CFR 172, Subpart H). The waste management subcontractor will have completed HAZMAT employee training and will renew the training as necessary to meet USDOT requirements for hazardous waste transportation. Martin State Airport (MSA) is listed as a U.S. Environmental Protection Agency (USEPA) “large quantity generator” (MDR000518760). Facilities that generate more than 1,000 kilograms per month of hazardous waste must comply with the emergency preparedness and personnel training requirements outlined in 40 CFR §265.16 (see 40 CFR §262.34[a][4]). This training is intended for the generator’s contractors (Tetra Tech) and includes training by a person qualified in hazardous waste management and emergency response procedures.

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Section 3

Hazardous Waste Determination and Process

Hazardous waste determinations shall be made in accordance with 40 *Code of Federal Regulations* (CFR) 262.11, using a combination of process knowledge and analytical evaluation of waste sampling. Hazardous waste determinations shall be reevaluated whenever any of the following occurs:

- a change in the process that produces the waste (e.g. a new chemical constituent is discovered, the treatment process changes, etc.)
- a change in the treatment media (e.g. new media vendor or media type)
- a waste is tainted by inadvertent mixing with another waste
- a change occurs to the hazardous waste regulations governing that waste

Waste generated during field investigations will include (but is not limited to) soil, sediment, water (surface, groundwater, purge, and/or decontamination water), and disposable personal protective equipment (PPE). PPE investigation derived waste (IDW) will be brushed off, placed in trash bags, and disposed of in a facility trash receptacle designated by Martin State Airport (MSA) personnel. IDW generated during field activities will be segregated into drums based upon historical data, when applicable, labeled to indicate the wells and locations from which the waste was generated, and the generation date. IDW generated during this activity will be further characterized and disposed of in accordance with state regulations unless state requirements are less stringent than federal requirements, in which case federal requirements shall apply.

When received from the analytical laboratory for the field investigations, the analytical data will be provided to the subcontractor to facilitate IDW classification, i.e., non-hazardous versus hazardous. IDW generated during previous sampling events were classified predominantly as non-hazardous; however, since then, in some cases IDW has been classified as hazardous.

Therefore, IDW materials may be characterized as hazardous during future sampling events conducted at MSA.

All analytical data shall be presented to the IDW subcontractor for classification of IDW generated from the field project. The IDW subcontractor will determine whether additional IDW sampling is required to complete the profiles based on the analytical data. If additional sampling is required to satisfy waste characterization parameters, Tetra Tech will schedule a site visit and oversee the sampling conducted by the IDW subcontractor.

Following receipt of the approved analytical data, the IDW subcontractor shall develop a profile for the waste. In some cases, if the IDW is classified under a waste stream that has already been profiled within the past year, a new profile will not be required and the IDW will be handled under the existing profile. In this case, an “Annual Generator Waste Recertification” form will be issued by the IDW subcontractor, which shall be signed and approved by Mike Musheno of LMC Properties, Inc. (LMCPI). If no existing profile applies, the new profile shall be sent to the Tetra Tech project manager for initial review. The Tetra Tech project manager will review and forward the waste profile forms to the appropriate site contact. All forms related to IDW from Martin State Airport will be signed and approved by Mike Musheno of LMCPI.

The “Waste Listing Assessment Form” is in Appendix A. This form will be completed by the Tetra Tech project manager as the first step in the IDW classification/removal process. It serves as first notification and is presented to the managing contractor for review. The form presents pertinent information such as the project name, description of the waste, date generated, type and classification of waste.

Lockheed Martin may choose to issue a Lockheed Martin “Hazardous-Waste-Manifest Signatory Authorization Form,” presented in Appendix B. This form authorizes a Lockheed Martin subcontractor to sign for the IDW and certifies that the representative has taken the USDOT training delineated in 49 CFR Part 172 *et seq.* and is in compliance with all state and federal requirements for hazardous waste manifesting. Lockheed Martin remains responsible and liable for the hazardous waste being disposed regardless of the signatory authorization provided on the form.

Following signature of the waste profile forms by Lockheed Martin or an authorized representative, the IDW will be scheduled for removal from the site. The Tetra Tech project

manager will coordinate the IDW removal with the appropriate Lockheed Martin site contact. The Lockheed Martin site contact or authorized representative shall be on-site to sign the bills of lading for nonhazardous IDW or the waste manifests for hazardous IDW. Signed copies of the returned bills of lading and waste manifests will be kept on file for at least three years and be available for review if requested.

Before IDW leaves the site, the Lockheed Martin site contact or authorized representative will complete a waste shipment checklist. (The “Hazardous Material/Waste Shipment Checklist” is presented in Appendix C for reference.) Completion of this checklist ensures that all protocols, standards and requirements have been adhered to and that the waste can be removed from the site. The checklist includes such line-item prompts as ensuring that the truck is fitted with proper waste placards, that the truck’s hazardous waste containers are double walled, and that waste manifests and bills of lading have been properly completed. Once the IDW is removed from the site, the Lockheed Martin representative and the Tetra Tech geologist will each be provided a copy of the associated paperwork. Tetra Tech will record the drums on a master “Drum Inventory Form” for each site. (A “Drum Inventory Form” is in Appendix D.)

A site contact list (Appendix E) will be maintained listing who shall be contacted in case of an emergency at the site or if questions arise about IDW disposal. An emergency contingency plan will be incorporated into the on-site health and safety plan and it will comply with all current and applicable regulations and requirements including, but not limited to OSHA 29 CFR 1903, 1904, 1910, and 1926. Lockheed Martin Corporation will be listed as the waste generator on all paperwork, including those waste profile sheets on which the generator was initially listed as Glenn L. Martin State Airport. The areas of Lockheed Martin investigations at MSA, including the Dump Road and Strawberry Point sites, Frog Mortar Creek, and Stansbury Creek, are identified by EPA ID number MDR000518760 for hazardous waste disposal.

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Section 4

Shipping Requirements

4.1 PRE-SHIPMENT REQUIREMENTS

Waste generated during sampling will include but is not limited to drill cuttings from monitoring well installation, decontamination water, purge water from monitoring wells, and sediment and surface water sampling. Investigation derived waste (IDW) generated during previous investigations has been characterized as both non-hazardous and hazardous waste. Pre-shipping requirements have been discussed in detail in section 3.0.

4.1.1 Packing

All waste materials will be collected in new or reconditioned United States Department of Transportation (USDOT)-approved 55-gallon drums that will be sealed at the end of daily sampling. Special consideration will be made to manage certain wastes (such as bentonite grout) separately from other IDW so as not to increase the volume of material that may be classified as hazardous due to elevated pH.

4.1.2 Labeling

Drums will be marked with appropriate “Hazardous” or “Non-Hazardous” labels that include the following information:

- **site** name where waste was generated (e.g. Martin State Airport)
- **location** where the waste was generated (i.e., well identification, soil boring, test pit, sediment and surface water location number)
- **date** when waste materials accumulation began
- **drum number** in the series of drums from this sampling event
- **contents**, i.e., sediment, soil cuttings, groundwater and surface water
- **volume** should be estimated and must not exceed three quarters of drum capacity

-
- **site contact and emergency contact information** for the designated authorized Lockheed Martin representative for the site and the telephone number of the local fire department.

4.1.3 Storing

IDW storage areas will meet the following specifications to permit access to the drums and to conduct spill/leak monitoring, sampling, and extraction once the disposal route is determined:

- A temporary spill containment system, made of polyethylene sheeting and 2-inch by 6-inch boards creating a bermed edge, will be placed under the container to contain any spills or leaks. The dimensions of the temporary spill-containment area will depend on the number of 55-gallon drums at the site. For most jobs, the spill containment area will likely be 10-feet by 20-feet. The integrity of the containment system will be monitored periodically.
- 55-gallon drums will be stored on self-contained pallets, with four or fewer drums per pallet. Self-contained pallets will be stored on a hard, flat surface covered with polyethylene sheeting.
- The drum-retaining bolt and label will be readily visible
- Four feet of space will be between each row of pallets/drums to allow access for sampling, drum removal, and spill response
- Caution tape or temporary fencing will be placed around the drums to help identify and secure the area
- Signs will be posted in front of the IDW storage area identifying the site, location, date of collection, number of drums, drum contents, volume of contents, site and emergency contact information, and the location of spill control materials for the wastes.
- Appropriate authorities will be informed that hazardous waste materials are on-site and of emergency response procedures. The emergency coordinator will be identified and emergency planning documented.
- A copy of work plans, waste disposal forms, and the IDW inventory list will be maintained on-site and provided to the project manager at the end of each shift
- Spill response equipment will be readily available
- Appropriate equipment will be used to move containers whenever possible, to avoid injury. When not possible, personnel will obtain help to manipulate containers.
- All storage containers will be monitored weekly to ensure that they remain in original condition and to ensure that no leaks or spills have occurred. Weekly inspections will be documented in a field notebook dedicated to the site and will include photographs.

The IDW drum storage area at MSA is on a flat concrete pad area near Gate 12; an alternative area may be used to minimize drum transportation. Airport personnel will determine IDW storage areas at Dump Road and Strawberry Point at the start of field activities. Single drums will be temporarily staged on a hard, flat surface overlain by polyethylene sheeting and self-contained plastic pallets that will act as secondary containment, with sufficient capacity to contain the contents of one 55-gallon drum. All IDW drums will be stored on secondary containment until they can be removed from the site. Lockheed Martin has 90 days to remove non-hazardous- and hazardous-waste drums from the facility. Access for the subcontractor's representative and IDW transport carrier will be coordinated by Tetra Tech.

4.1.4 Material Identification and Classification

All waste materials shall be identified and classified per USDOT requirements.

4.1.5 Waste Shipment

Tetra Tech will subcontract all IDW removal. Tetra Tech will ensure the use of Lockheed Martin purchasing agreements and associated Lockheed Martin-approved waste-management vendors and will ensure that hazardous waste is transported by an approved vendor to a treatment, storage, and disposal (TSD) facility on the Lockheed Martin "Corporate Hazardous Waste Approved Vendors" list. Non-hazardous waste is not required to be managed by Lockheed Martin approved waste management vendors but shall be transported to an approved industrial waste disposal facility. The Lockheed Martin "Hazardous Waste Manifest Signatory Authorization" (Attachment D) must be filled out by the Lockheed Martin project lead in coordination with the Tetra Tech project manager if the IDW is hazardous.

4.1.6 Hazardous Waste Generator Identification Number

The Lockheed Martin USEPA identification number for hazardous waste generation at MSA is MDR000518760. All IDW will be removed from the site by a subcontractor adhering to the shipping requirements in Section 4.2.

4.2 SHIPPING REQUIREMENTS

USDOT HAZMAT employee training is required for anyone involved in shipment preparation, offering for transport and transportation of hazardous waste, including signing hazardous waste manifests (see 49 CFR 172, Subpart H). The manifest for the waste to be shipped must be

certified as accurate. Non-hazardous materials do not require the signature of a USDOT HAZMAT-trained individual. A waste manifest will be signed for all hazardous waste and a bill of lading will be signed for all non-hazardous waste. For non-hazardous waste, Tetra Tech will use the Lockheed Martin “Hazardous Material/Waste Shipment Checklist” (Attachment B) during preparation and pre-transport review of waste shipments and will submit a completed electronic copy to the Lockheed Martin Project Lead with the shipping documentation.

Detailed records of authorized work will be maintained by the subcontractor, including all manifests of waste transported to the approved off-site disposal facility, receipt of waste acceptance by the approved treatment/disposal facility, certification that the waste has been disposed of at the approved facility, receipt of acceptance of waste containers by the approved disposal facility, certification of disposal of waste containers by the approved disposal facility, weighing slips, and any other documentation required by local, state, or federal requirements.

4.3 POST-SHIPMENT REQUIREMENTS

Waste characterization, chain of custody, transportation, and destruction records will be scanned and submitted electronically to the Lockheed Martin project lead for records retention. This will include profile sheets, the “Hazardous Material/Waste Checklist,” the generator copy of the waste manifest, a copy of the treatment, storage, and disposal (TSD)- signed manifest, “Land Disposal Restriction” forms, and certificates of waste destruction, when applicable. All monitoring records will be submitted for each year’s waste generation activities in the first quarter of the following year or per the project lead’s direction. The documentation noted above must be kept for at least three years. All documents must be available for review if requested.

APPENDIX A—WASTE IDENTIFICATION AND CLASSIFICATION FORM

Waste Identification and Classification Form

LMC Remediation Project

State Generated

Description of Waste

Generic Name

Solid, Liquid, Gas

Additional Info.

Date of Waste Generation

Ongoing (Y/N)?

Description of Process Generating Waste

Listed Waste ? (Y/N)

F,K, P or U Codes, if applicable

Justification for Waste Classification (attach support documentation)

Completed by

Company

Date

**APPENDIX B—HAZARDOUS WASTE MANIFEST
SIGNATURE AUTHORIZATION FORM**

Lockheed Martin Hazardous Waste Manifest Signatory Authorization

This Authorization Agreement, effective for the remediation site and period of performance written below, is entered into by and between:

LOCKHEED MARTIN CORPORATION (hereinafter "Lockheed Martin"),
having a business office at 6801 Rockledge Drive, Bethesda, Maryland 20817
USA, and incorporated in the State of Maryland, and

(hereinafter "_____")

having a business office at _____

_____.

WHEREAS, _____ (company representative) of
_____ (company) will sign Hazardous Waste Manifests on behalf of
Lockheed Martin for the project and hazardous waste, as defined at 40 CFR Pt.
261 *et seq.* indicated below.

Remediation Site: _____

Site Address: _____

Period of Performance: _____

Hazardous Waste Description:

Hazardous Waste Disposal Facility and Location: _____

This Authorization Agreement certifies that the representative signing on behalf of Lockheed Martin has taken the appropriate Department of Transportation training, as delineated at 49 CFR Part 172 *t seq.* to sign Hazardous Waste Manifests and is in compliance with all state and federal requirements for hazardous waste manifesting.

Lockheed Martin shall remain responsible and liable for the hazardous waste being disposed regardless of the Signatory Authorization provided herein.

LOCKHEED MARTIN CORPORATION

By:_____

By:_____

Name:_____

Name:_____

Title:_____

Title:_____

Date:_____

Date:_____

APPENDIX C—HAZARDOUS MATERIAL/WASTE SHIPMENT CHECKLIST

Lockheed Martin Hazardous Material/Waste Shipment Checklist

Date:

Project Site Name:

Shipping Document No.:

A. DESCRIPTION

- A1. _____ UN/NA Identification Number, Proper Shipping Name, Hazard Class/Division Number, Packing Group
A2. _____ Subsidiary hazard class(es) or division number(s), if any, in parenthesis
A3. _____ Total Quantity of Material
A4. _____ 24-Hour Emergency Phone Number and Response Information ERG No.: _____
A5. _____ Page of Pages, *for multiple shipping papers/EPA Manifest/Air Decs.*
A6. _____ Shipper's Certification, *as applicable*
A7. _____ Small Quantity Exception/Dangerous Goods In Excepted Quantities/Diagnostic Specimen/Sample

B. ADDITIONAL DESCRIPTIONS - GENERAL

- B1. _____ Exemptions "DOT-E-ex.#"
B2. _____ "Limited Quantity" (*not to exceed 66 lb gross weight*)
B3. _____ "X" or "RQ" (if RQ, Hazardous Substance Contact @ 1-800-424-8802)
B4. _____ "Waste" for RCRA regulated material
B5. _____ "Mixture" or "Solution" - as appropriate.
B6. _____ (*technical names*), *for poisons/mixtures/n.o.s./generic proper shipping names*
B7. _____ "Marine Pollutant" and constituent in (), *for bulk shipments only*
B8. _____ (*hazardous substance names*) *per 172.101 appendix if not contained in proper shipping name*
B9. _____ (*EPA waste identification numbers*)- *used to identify the hazardous substance*
B10. _____ "Poison" - *if not identified in proper shipping name or hazard class*
B11. _____ "Poison-Inhalation Hazard" & Zone A, Zone B, Zone C, or Zone D, as appropriate*
 (*Note Special Provisions 1-6 and 13 in Column 7 of 172.101)

C. MARKING FOR NON-BULK PACKAGINGS

- C1. _____ Proper Shipping Name, UN/NA Identification Number
C2. _____ (*technical name*)
C3. _____ (*EPA waste identification number*)
C4. _____ "RQ"
C5. _____ Exemption Packagings "DOT-E-ex.#"
C6. _____ Consignee's Name & Address
C7. _____ Net or Gross quantity for non-rad Dangerous Goods (adjacent to PSN & UN#)
C8. _____ Ltd. Qty - PSN only *per 172.301(a)(1) or UN ID# placed in square-on-point border per 172.315*
C9. _____ Package Orientation Arrows, *for liquids in inner packagings*
C10. _____ "Inhalation Hazard", unless these words appear on the label prescribed in 172.416 or 172.429
C11. _____ "Overpack" adjacent to proper shipping name marking [*see 173.25(a)(4)*]
C12. _____ TSCA PCB Marking (*for actual or source concentration greater than or equal to 50 ppm* *)
 (* Note Potential Vehicle Marking Requirements in 40 CFR 761.40)

D. MARKING FOR BULK PACKAGINGS (DUMP TRUCKS OR ROLL-OFFS)

- D1. _____ UN/NA Identification Number on orange panel or placard or white square-on-point display configuration as prescribed by 172.302 and 172.332

E. LABELING

- E1. _____ Primary Hazard Label(s): _____
E2. _____ Subsidiary Hazard Label(s) with class/division: _____
E3. _____ Hazardous Wastes Label(s)

F. PLACARDING

- F1. 172.504 Table 1 Materials - Any Amount
 F1.1. _____ Dangerous When Wet (4.3)
 F1.2. _____ Poison (6.1, Inhalation Hazard, Zone A or B)* (Primary or Subsidiary _____)
 (*Materials subject to the "Poison-Inhalation Hazard" notation must be placarded with a POISON INHALATION HAZARD or POISON GAS placard, as appropriate, and also placarded for any other hazard class required for that material in 172.504)
 F1.3. _____ Radioactive (7, LSA/SCO Exclusive Use Shipments)

- F2. 172.504 Table 2 Materials - 1,001 lb:

Lockheed Martin Hazardous Material/Waste Shipment Checklist

G. PACKAGING

- G1. _____ Container Type: (Inner Pkg) _____
- G2. _____ Container Type: (Outer Pkg) _____
- G3. _____ Container Type: (Bulk Pkg) _____
- G4. _____ Loaded and Closed As Required _____

H. PAPERWORK AND MISCELLANEOUS ITEMS

- H1. _____ Shipping Paper/Hazardous Waste Manifest/Bill of Lading/Airway Bill/Shipper's Declaration
- H2. _____ Instructions for Maintenance of Exclusive Use Shipments
- H3. _____ Small Quantity/Excepted Quantity Statement on Package, *for 173.4 shipments / DGEQ statement per 2.7.7.2*
noted on Airway Bill
- H4. _____ Photograph, *if applicable*
- H5. _____ Vehicle Inspection
- H6. _____ Check Driver's Qualifications
- H7. _____ Emergency Telephone Number Notification, if required, see 172.604(b)
- H8. _____ LMC Notification Instructions

I. ADDITIONAL REQUIREMENTS FOR RADIOACTIVE MATERIAL SHIPMENTS

- I1. SHIPPING PAPER DESCRIPTIONS
 - I1.1. _____ Radionuclide Symbol(s), *per 173.435*
 - I1.2. _____ Physical & Chemical Form, *if not special form*
 - I1.3. _____ Activity per Package
 - I1.4. _____ Radioactive Labels
 - I1.5. _____ Fissile Excepted, *if applicable*
 - I1.6. _____ "Exclusive Use Shipment"
- I2. MARKING FOR NON-BULK PACKAGINGS
 - I2.1. _____ Gross Weight, *for radioactive material packages in excess of 110 lb*
 - I2.2. _____ "Radioactive"; "Radioactive – LSA"; "Radioactive – SCO"
 - I2.3. _____ Package Certification Number, *for radioactive material packages, as appropriate*
 - I2.4. _____ IP-1, IP-2, IP-3 markings
 - I2.5. _____ "USA" on all IP and Type A packagings
 - I2.6. _____ Packaging manufacturer marking on Type A
- I3. LABELING
 - I3.1. _____ Radioactive Labels
 - I3.2. _____ "EMPTY" Label
 - I3.3. _____ "Radioactive Material, Excepted Package" handling label
- I4. PLACARDING (172.504 TABLE 1 MATERIALS - ANY AMOUNT)
 - I4.1. _____ Radioactive (7, LSA/SCO Exclusive Use Shipments)
- I5. PAPERWORK AND MISCELLANEOUS ITEMS
 - H1. _____ Instructions for Maintenance of Exclusive Use Shipments
 - H2. _____ Radioactive Excepted Package statement per 10.8.8.3.3 on Airway Bill
 - H3. _____ Limited Quantity Radioactive Material *for multiple hazard limited quantity Class 7.*
 - H4. _____ Health Physics Information
 - H5. _____ NRC Manifest #540 for radioactive waste shipment for land disposal.

Completed By:

Company:

Date:

APPENDIX D—DRUM INVENTORY FORM

DRUM INVENTORY

PROJECT NUMBER:**LOCATION:****DATE (START):** _____**DATE (END):** _____[illegible]

APPENDIX E—SITE CONTACT SHEET

Site Contact List

- 1) Charles Baublitz: Airport Operations Manager
Office 410-682-8831
- 2) Al Pollard: Director
Office 410-682-8800
- 3) Thomas Thompson: Airport Operations Engineer
Office: 410-682-8856
- 4) Mike Musheno: ESH / Projects
Office: 484-682-1315
- 5) Major Peter Loebach:
Office: 410-918-6486
- 6) A&A Environmental / Spill Response: 1-800-404-8037
- 7) Tony Apanavage Project Manager 1-301-528-3021 (office)
1-301-233-8230 (cell)
- 8) Michael Martin Program Manager 1-301-528-3022 (office)
1-410-707-5259 (cell)
- 9) Baltimore County Police & Fire Department: 911
- 10) State of Maryland Emergency Response Center (410-974-3551)

**APPENDIX F—“EESH REMEDIATION OPERATING PROCEDURE NO: EROP-03,
“EESH REMEDIATION WASTE MANAGEMENT**

Subject: EESH Remediation Waste Management

- Ref: 1. Code of Federal Regulations, Title 40, Parts 260, 261, 262, 264, 265, 268, 761, and 763
2. Code Federal Regulations, Title 49, Parts 100 through 180
3. Corporate Functional Procedure No: ESH-06
4. Corporate Functional Procedure No: ESH-08
4. Corporate Policy Statement 527

1.0 Purpose

This procedure establishes practices for management and transportation of solid and hazardous waste (waste in this context also refers to DOT hazardous materials) generated at remediation project sites in a manner that complies with Subtitle C of the Resource Conservation and Recovery Act (RCRA), Department of Transportation (DOT) regulations, and similar state and/or host country waste regulations. Additionally, this procedure ensures waste disposal is managed in accordance with Corporate Functional Procedure ESH-06 and ESH-08, and records retained in accordance with Corporate Policy Statement 527.

2.0 Applicability

This procedure applies to the Energy, Environment, Safety and Health (EESH) Remediation Organization (the Organization) and to the remediation projects for which the Organization has waste management responsibility. Each member of the Organization, including IWTA, contractor staff and, where applicable, support organizations (e.g. Global Supply Chain Management), is responsible for execution of this procedure.

The materials to which this practice applies are solid wastes generated as a result of remediation project activities, including such things as investigation derived waste, environmental sampling, treatment of contaminated media, and routine operations and maintenance, unless such solid waste is exempt under applicable regulations.

3.0 Key National Agreement

Waste management requirements shall be included within the EESH Key National Agreements (KNA). The KNA establishes the requirements under which Remediation Contractors perform work for Lockheed Martin.

The KNA will stipulate that the Remediation Contractor shall comply with Lockheed Martin waste management, transportation, and disposal requirements and all applicable state, federal, and/or host country laws and regulations.

4.0 Statement of Work Requirements

4.1 Waste Management Plan

All remediation project statements of work that include the generation of solid waste, excluding office trash (e.g. food wastes, consumer packaging) that may be disposed of at a municipal solid waste facility, shall include a requirement for the waste management contractors (i.e. Remediation Contractors and/or Corporate Approved Waste Management Vendors) to submit a waste management plan to Lockheed Martin. A site specific waste management plan shall be prepared that identifies all potential solid waste streams that may reasonably be expected to be generated or discovered during project activities. The plan will address the required elements listed below; however, if the waste is determined to be non-hazardous following completion of Element A, then only the additions of Elements D and E are required.

Element A) Hazardous Waste Determination

- i) Listing assessment (See Attachment #1 – Waste Listing Assessment Form)
- ii) Characteristic determination

Hazardous waste determinations shall be made in accordance with 40 CFR 262.11 using a combination of process knowledge and/or analytical evaluation of waste sampling. Hazardous waste determinations shall be reevaluated whenever any of the following circumstances occur:

- A change in the process that produces the waste (e.g. a new chemical constituent is discovered, the treatment process changes);
- A change in the treatment media is made (e.g. new media vendor or media type);
- A waste was tainted by inadvertent mixing with another waste; or
- A change occurred to the hazardous waste regulations that apply to that waste.

Characteristic waste determinations based on analytical sampling shall be reevaluated at some reasonable frequency to verify the accuracy of the initial waste determination. The waste determination reevaluation frequency for ongoing remediation or treatment operations should be specified in the waste management plan and be profiled at least once a year.

Element B) Responsibilities and Training Requirements

- i) Contractor staff responsibilities with regard to waste management and training requirements necessary to comply with Section 6.0 and all state, federal, and/or host country laws and regulations. Contractor training certifications shall be provided electronically to the Lockheed Martin Project Lead.

Element C) Pre-Shipment Requirements

- i) Material identification and classification per DOT requirements
- ii) Packaging, storage, segregation, marking, labeling, and accumulation of waste
- iii) Waste shipment documentation
 - (1) Hazardous Waste Generator Identification Number

- iv) Hazardous Material Transportation Plan
 - (1) Hazardous material transportation risk identification, prioritization, and mitigation plan
 - (2) Emergency Response (material information to be provided with shipments, actions to be taken in the event of an incident, staffing the emergency response phone number)
 - (3) Hazmat Security Plan (as required based on thresholds outlined in 49 CFR §172.800)
 - (4) Transportation and disposal logistics

Lockheed Martin Project Leads shall ensure the use of the Lockheed Martin Corporate Purchasing Agreements and the associated Corporate Approved Waste Management Vendors (WMV) for hazardous waste management and ensure that waste is transported to a treatment, storage, and disposal (TSD) facility on the Lockheed Martin Corporate Hazardous Waste Approved Vendors List as outlined in the ESH-06. Remediation contractors can contract directly with the WMV.

Additionally, hazardous waste manifests shall be signed only by a DOT trained and qualified Lockheed Martin employee or authorized designee (See Attachment #2 – Hazardous Waste Manifest Authorization Form). In addition to completing the Authorization Form, Project Leads shall verify that the designee is DOT trained and qualified to sign manifests and has adequate DOT experience. It is preferable to have contractors designated to sign that are involved in the waste characterization and oversight. For contractor personnel handling hazardous waste, appropriate hazardous waste handling training shall be provided by the contractor as outlined in Section 6.0 and complying with all state, federal, and/or host country laws and regulations.

Non-hazardous waste is not required to be managed by Corporate Approved Waste Management Vendors but shall be transported to an approved industrial waste disposal facility as outlined in ESH-06.

Within the United States, waste shall be characterized and disposed in accordance with the state regulations where it was generated unless the state requirements are less stringent than the federal requirements. For instance, California non-RCRA hazardous waste cannot be disposed of in a non-hazardous waste facility. Within a host country, waste shall be managed in accordance with the host country regulations; however, if the host country standards are less stringent than those of the US Environmental Protection Agency (EPA), then the EPA standards shall apply.

Element D) Shipping Requirements

- i) Manifest certification and accuracy verification of physical waste shipment against manifested waste shipment (for non-hazardous waste this may not be applicable)
 - (1) For hazardous waste, the contractor responsible for waste shipment shall utilize the Lockheed Martin Hazardous Material/Waste Shipment Checklist (see Attachment #3) during the preparation and pre-transport review of waste shipments and submit a completed electronic copy to the Lockheed Martin Project Lead with the shipping documentation.

- ii) For non-specification bulk containers (e.g. dump trucks and roll-offs), the contractor responsible for waste shipment shall adhere to the Lockheed Martin requirements for packing and closing (see Attachment #4). These requirements are meant to supplement the applicable regulations.

Element E) Post Shipment Requirements - Records

- i) Waste characterization, chain of custody, transportation, and destruction records shall be scanned and electronically submitted to the Lockheed Martin Project Lead for records retention. This shall include profile sheets, the Hazardous Material/Waste Checklist, the generator copy of the waste manifest, a copy of the TSD signed waste manifest, Land Disposal Restriction forms, and certificates of waste destruction where applicable. For finite-duration remediation projects, waste transportation and disposal records shall be submitted to the project lead at the completion of the project unless submittals are required by regulatory agencies on a more frequent basis. For recurring remediation project activities such as annual groundwater monitoring or groundwater treatment, these records shall be submitted for each year's waste generation activities in the first quarter of the following year or per the Project Lead's direction.

The waste management plan shall be submitted in a phased approach. The first section of the waste management plan will provide the hazardous listing assessment and the characteristic determination methodology (addressing Element A). This section of the plan shall be submitted in a timeframe that allows for Lockheed Martin's review prior to waste generation. Upon approval to proceed, the second section will document the waste profiling results and must be signed off on by a Lockheed Martin Project Lead. Additionally, it shall outline the logistics for waste handling, transportation and disposal (addressing Elements B through E). This section of the plan shall specify a reevaluation frequency for waste generated as a result of ongoing remediation or treatment operations.

Following the approval of the second section by the Lockheed Martin Project Lead, the waste management contractor shall implement the waste management plan. This plan shall be updated when the remedial treatment system process, waste stream, media, or regulations change.

4.2 Health and Safety Plan

For remediation sites managing waste, a section shall be included in the site Safety and Health Plan to address the safety and health requirements for managing the site specific waste.

4.3 Electronics and Scrap Metal Recycling

Where applicable and feasible, electronics and scrap metals shall be recycled or refurbished to the extent possible in accordance with ESH-06.

5.0 Responsibilities

5.1 Project Lead

The Project Lead shall:

- Ensure that all remediation projects for which they have responsibility have a waste management plan as outlined in Section 4.0. Review and ensure updates are completed as necessary. Plans must also be submitted to the Records Manager for upload to the Document Management System (DMS).
- Consult with Corporate EESH Legal as needed to verify the listing determination.
- Ensure that the Contractor has outlined the applicable training requirements and provided a training plan or statement of completion within the waste management plan.
- Verify that the site has a Hazardous Waste Generator Identification Number prior to hazardous waste shipments, where applicable.
- Ensure that all hazardous waste manifests are signed and certified by a Lockheed Martin employee or authorized designee. For non-hazardous waste, there are no signatory requirements for waste manifests.
- Ensure that non-hazardous or hazardous waste is shipped to an approved facility per ESH-06 and that the Corporate Approved Waste Management Vendors are being used for hazardous waste transportation, storage, and/or disposal services.
- Ensure receipt of the waste characterization, chain of custody, transportation, and destruction records, where applicable, and submit them to the Records Manager for upload to the DMS.
- Ensure that the required regulatory and state hazardous waste reports are submitted (e.g. biennial waste reports).

5.2 Remediation Global Supply Chain Management Representative

The Global Supply Chain Representative shall:

- Ensure that the KNA includes the requirements defined in Section 3.0.
- Send the Remediation Contractors an updated version of the approved non-hazardous facility list quarterly.
- Send the Corporate Approved Waste Management Vendors an updated version of the Lockheed Martin Corporate Hazardous Waste Approved Vendors List quarterly.

5.3 Corporate EESH Legal

The Corporate EESH Legal Counsel shall:

- Provide the Project Lead with support when making listed waste determinations.
- Notify the Project Leads of regulation changes that would affect prior listing determinations.

6.0 Training Requirements

The EESH remediation staff training requirements are summarized in Table 1.

6.1 RCRA Hazardous Waste Handling and Emergency Procedures

RCRA Generator Status Facilities

Generators who generate more than 1,000 kg/month of hazardous waste (or more than 1 kg/month of acutely hazardous waste) must comply with the emergency preparedness and personnel training requirements outlined in 40 CFR §265.16 (see 40 CFR §262.34(a)(4)). This training is intended for all facility personnel including the generator's contractors and includes training by a qualified person on hazardous waste management and emergency response procedures. Personnel shall receive an annual refresher. Project Leads are responsible for ensuring this training is provided to contractor staff on remediation projects that meet this generator criterion. Contractor personnel training records must also be maintained by the Project Lead.

"Small quantity generators" who generate greater than 100 kg but less than 1000 kg/month of hazardous waste, must comply with the emergency preparedness and personnel training requirements at 40 CFR §262.34(d)(5). These generators "must ensure that all employees are thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies" (40 CFR §262.34 (d)(5)(iii)). Project Leads shall ensure that all contractor staff has had the appropriate hazardous waste handling and emergency procedure training on remediation projects that meet this generator criterion.

Federal training requirements do not apply to remediation projects that generate less than 100 kg/month of hazardous waste. However, Project Leads shall ensure that the contractor staff is familiar with hazardous waste handling and emergency procedure training appropriate for waste management.

RCRA Permitted or Interim Status Facilities

Permitted or interim status facilities must follow training requirements in accordance with 40 CFR §264.16 and 40 CFR §265.16, respectively (the same requirements apply as outlined in the first paragraph under Section 6.1).

Additional training may be required by state and/or host country hazardous waste regulations. Any such additional training shall be verified and implemented by the Project Lead.

6.2 Department of Transportation Training

Department of Transportation (DOT) Hazmat Employee training is required for a person involved in shipment preparation, offering for transport and transportation of hazardous waste, including signing of hazardous waste manifests (see 49 CFR 172, Subpart H). All Lockheed Martin Remediation representatives, designees, and/or waste management contractors shall complete the hazmat employee training and renew the training as necessary to meet DOT requirements for hazardous waste transportation.

6.3 OSHA HAZWOPER Training

All contractors working on Lockheed Martin remediation sites shall complete the appropriate OSHA hazardous waste operations (HAZWOPER) training and annual refresher training specified in 29 CFR §1910.120. Lockheed Martin employees managing projects where hazardous waste is generated shall complete the 24 hour OSHA HAZWOPER training and annual refresher training.

7.0 Deviations

All deviations from this procedure must have prior approval by the Director of Environmental Remediation. The approval shall be documented and uploaded to the DMS.

Table 1

EESH Remediation Staff Waste Management Training Matrix			
Function	Task	Training Required	Requirements
EESH Remediation Employees (including IWTA and managing contractor staff (where the task description matches responsibilities))	Completing / Approving Waste Determinations	RCRA Generator Training	Refresher every 5 years
	Managing Remediation Sites where Hazardous Waste is Generated	OSHA HAZWOPER 24 HR	8 hr refresher annually
	Managing Hazardous Waste Shipments	DOT HazMat Certification (see Table 2)	Refresher every 3 years

The Lockheed Martin Project Lead shall update the Remediation Waste Management Training Matrix located on the Remediation Process Asset Library once training has occurred. All training and certification documentation will reside on the Remediation DMS under Training Records.

Table 2

EESH Remediation Staff DOT Requirements for Hazmat Employees	
Requirement	Completion Method
General Awareness [49 CFR 172.704(a)(1)]	<ul style="list-style-type: none"> • Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME)
Function-Specific [49 CFR 172.704(a)(2)]	<ul style="list-style-type: none"> • Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME)
Safety [49 CFR 172.704(a)(3)]	<ul style="list-style-type: none"> • Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME) • Hazwoper 24 Hour Training • Site specific safety training [NOTE: This element of safety training may be fulfilled through completing any one (1) of the following three (3) options which provides the required site specific safety information: 1) Site Safety Plan Review, 2) Site HazCom/ General Employee Training or 3) Site Visitor Safety Briefing/Training. The source of the training must be entered as part of the information on the test which is administered for site specific safety training.]
Security Awareness [49 CFR 172.704(a)(4)]	<ul style="list-style-type: none"> • Vendor (e.g. Lions) provided Hazardous Materials Transportation Workshop • DOT OJT (taught by EESH DOT SME) • Site specific security awareness training [NOTE: This element of security awareness training may be fulfilled through completing any one (1) of the following three (3) options which provides the required site specific security information: 1) Site Security Plan Review, 2) Site HazCom/General Employee Training or 3) Site Visitor Security Briefing/Training. The source of the training must be entered as part of the information on the test which is administered for site specific security training.]
In-Depth Security (Hazmat Security Plan) Only applicable when haz material/waste meets certain class and volume thresholds (reference Section 4.1, Element C, iv, 4) [49 CFR 172.704(a)(5)]	<ul style="list-style-type: none"> • Site Hazmat Transportation Security Plan Training

The EESH DOT SME will certify EESH Remediation staff members as DOT Hazmat Employees on behalf of Lockheed Martin once training and safety and security tests have been completed.

Attachment #1

Waste Listing Assessment Form



Waste Listing
Assessment Form

Attachment #2

Hazardous Waste Manifest Signature Authorization Form



Designee
Authorization Form

Attachment #3

Hazardous Material/Waste Shipment Checklist



Hazardous Material/
Waste Shipment Che

Attachment #4

Non-Specification Bulk Container Packing and Closing Instructions



Non-Specification
Bulk Container Packin

Waste Listing Assessmet Form

LMC Remediation Project	<input type="text"/>	State Generated	<input type="text"/>
Description of Waste	<input type="text"/>		
Generic Name	<input type="text"/>	Solid, Liquid, Gas	<input type="text"/>
		Additional Info.	<input type="text"/>
Date of Waste Generation	<input type="text"/>	Ongoing (Y/N)?	<input type="text"/>
Description of Process Generating Waste			
<input type="text"/>			
Listed Waste ? (Y/N)	<input type="text"/>	F,K, P or U Codes, if applicable	<input type="text"/>
Justification for Waste Classification (attach support documentation)			
<input type="text"/>			
Completed by <input type="text"/>			
Company <input type="text"/>			
Date <input type="text"/>			

Lockheed Martin Hazardous Waste Manifest Signatory Authorization

This Authorization Agreement, effective for the remediation site and period of performance written below, is entered into by and between:

LOCKHEED MARTIN CORPORATION (hereinafter "Lockheed Martin"),
having a business office at 6801 Rockledge Drive, Bethesda, Maryland 20817
USA, and incorporated in the State of Maryland, and

(hereinafter "_____")

having a business office at _____

_____.

WHEREAS, _____ (company representative) of
_____ (company) will sign Hazardous Waste Manifests on behalf of
Lockheed Martin for the project and hazardous waste, as defined at 40 CFR Pt.
261 *et seq.* indicated below.

Remediation Site: _____

Site Address: _____

Period of Performance: _____

Hazardous Waste Description:

Hazardous Waste Disposal Facility and Location: _____

This Authorization Agreement certifies that the representative signing on behalf of Lockheed Martin has taken the appropriate Department of Transportation training, as delineated at 49 CFR Part 172 *t seq.* to sign Hazardous Waste Manifests and is in compliance with all state and federal requirements for hazardous waste manifesting.

Lockheed Martin shall remain responsible and liable for the hazardous waste being disposed regardless of the Signatory Authorization provided herein.

LOCKHEED MARTIN CORPORATION

By: _____

By: _____

Name: _____

Name: _____

Title: _____

Title: _____

Date: _____

Date: _____

Lockheed Martin Hazardous Material/Waste Shipment Checklist

Date:

Project Site Name:

Shipping Document No.:

A. DESCRIPTION

- A1. _____ UN/NA Identification Number, Proper Shipping Name, Hazard Class/Division Number, Packing Group
- A2. _____ Subsidiary hazard class(es) or division number(s), if any, in parenthesis
- A3. _____ Total Quantity of Material
- A4. _____ 24-Hour Emergency Phone Number and Response Information ERG No.: _____
- A5. _____ Page of Pages, *for multiple shipping papers/EPA Manifest/Air Decs.*
- A6. _____ Shipper's Certification, *as applicable*
- A7. _____ Small Quantity Exception/Dangerous Goods In Excepted Quantities/Diagnostic Specimen/Sample

B. ADDITIONAL DESCRIPTIONS - GENERAL

- B1. _____ Exemptions "DOT-E-ex.#"
- B2. _____ "Limited Quantity" (*not to exceed 66 lb gross weight*)
- B3. _____ "X" or "RQ" (if RQ, Hazardous Substance Contact @ 1-800-424-8802)
- B4. _____ "Waste" for RCRA regulated material
- B5. _____ "Mixture" or "Solution" - as appropriate.
- B6. _____ (*technical names*), *for poisons/mixtures/n.o.s./generic proper shipping names*
- B7. _____ "Marine Pollutant" and constituent in (), *for bulk shipments only*
- B8. _____ (*hazardous substance names*) *per 172.101 appendix if not contained in proper shipping name*
- B9. _____ (*EPA waste identification numbers*)- *used to identify the hazardous substance*
- B10. _____ "Poison" - *if not identified in proper shipping name or hazard class*
- B11. _____ "Poison-Inhalation Hazard" & Zone A, Zone B, Zone C, or Zone D, as appropriate*
(*Note Special Provisions 1-6 and 13 in Column 7 of 172.101)

C. MARKING FOR NON-BULK PACKAGINGS

- C1. _____ Proper Shipping Name, UN/NA Identification Number
- C2. _____ (*technical name*)
- C3. _____ (*EPA waste identification number*)
- C4. _____ "RQ"
- C5. _____ Exemption Packagings "DOT-E-ex.#"
- C6. _____ Consignee's Name & Address
- C7. _____ Net or Gross quantity for non-rad Dangerous Goods (adjacent to PSN & UN#)
- C8. _____ Ltd. Qty - PSN only *per 172.301(a)(1) or UN ID# placed in square-on-point border per 172.315*
- C9. _____ Package Orientation Arrows, *for liquids in inner packagings*
- C10. _____ "Inhalation Hazard", unless these words appear on the label prescribed in 172.416 or 172.429
- C11. _____ "Overpack" adjacent to proper shipping name marking [*see 173.25(a)(4)*]
- C12. _____ TSCA PCB Marking (*for actual or source concentration greater than or equal to 50 ppm **)
(* Note Potential Vehicle Marking Requirements in 40 CFR 761.40)

D. MARKING FOR BULK PACKAGINGS (DUMP TRUCKS OR ROLL-OFFS)

- D1. _____ UN/NA Identification Number on orange panel or placard or white square-on-point display configuration as prescribed by 172.302 and 172.332

E. LABELING

- E1. _____ Primary Hazard Label(s): _____
- E2. _____ Subsidiary Hazard Label(s) with class/division: _____
- E3. _____ Hazardous Wastes Label(s)

F. PLACARDING

- F1. 172.504 Table 1 Materials - Any Amount
 - F1.1. _____ Dangerous When Wet (4.3)
 - F1.2. _____ Poison (6.1, Inhalation Hazard, Zone A or B)* (Primary or Subsidiary _____)
(*Materials subject to the "Poison-Inhalation Hazard" notation must be placarded with a POISON INHALATION HAZARD or POISON GAS placard, as appropriate, and also placarded for any other hazard class required for that material in 172.504)
 - F1.3. _____ Radioactive (7, LSA/SCO Exclusive Use Shipments)

- F2. 172.504 Table 2 Materials - 1,001 lb:

Lockheed Martin Hazardous Material/Waste Shipment Checklist

G. PACKAGING

- G1. _____ Container Type: (Inner Pkg) _____
- G2. _____ Container Type: (Outer Pkg) _____
- G3. _____ Container Type: (Bulk Pkg) _____
- G4. _____ Loaded and Closed As Required _____

H. PAPERWORK AND MISCELLANEOUS ITEMS

- H1. _____ Shipping Paper/Hazardous Waste Manifest/Bill of Lading/Airway Bill/Shipper's Declaration
- H2. _____ Instructions for Maintenance of Exclusive Use Shipments
- H3. _____ Small Quantity/Excepted Quantity Statement on Package, *for 173.4 shipments / DGEQ statement per 2.7.7.2*
noted on Airway Bill
- H4. _____ Photograph, *if applicable*
- H5. _____ Vehicle Inspection
- H6. _____ Check Driver's Qualifications
- H7. _____ Emergency Telephone Number Notification, if required, see 172.604(b)
- H8. _____ LMC Notification Instructions

I. ADDITIONAL REQUIREMENTS FOR RADIOACTIVE MATERIAL SHIPMENTS

- I1. SHIPPING PAPER DESCRIPTIONS
 - I1.1. _____ Radionuclide Symbol(s), *per 173.435*
 - I1.2. _____ Physical & Chemical Form, *if not special form*
 - I1.3. _____ Activity per Package
 - I1.4. _____ Radioactive Labels
 - I1.5. _____ Fissile Excepted, *if applicable*
 - I1.6. _____ "Exclusive Use Shipment"
- I2. MARKING FOR NON-BULK PACKAGINGS
 - I2.1. _____ Gross Weight, *for radioactive material packages in excess of 110 lb*
 - I2.2. _____ "Radioactive"; "Radioactive – LSA"; "Radioactive – SCO"
 - I2.3. _____ Package Certification Number, *for radioactive material packages, as appropriate*
 - I2.4. _____ IP-1, IP-2, IP-3 markings
 - I2.5. _____ "USA" on all IP and Type A packagings
 - I2.6. _____ Packaging manufacturer marking on Type A
- I3. LABELING
 - I3.1. _____ Radioactive Labels
 - I3.2. _____ "EMPTY" Label
 - I3.3. _____ "Radioactive Material, Excepted Package" handling label
- I4. PLACARDING (172.504 TABLE 1 MATERIALS - ANY AMOUNT)
 - I4.1. _____ Radioactive (7, LSA/SCO Exclusive Use Shipments)
- I5. PAPERWORK AND MISCELLANEOUS ITEMS
 - H1. _____ Instructions for Maintenance of Exclusive Use Shipments
 - H2. _____ Radioactive Excepted Package statement per 10.8.8.3.3 on Airway Bill
 - H3. _____ Limited Quantity Radioactive Material *for multiple hazard limited quantity Class 7.*
 - H4. _____ Health Physics Information
 - H5. _____ NRC Manifest #540 for radioactive waste shipment for land disposal.

Completed By:

Company:

Date:

**PACKING AND CLOSING INSTRUCTIONS FOR
NON-SPECIFICATION BULK CONTAINERS
(DUMP TRUCKS AND ROLL-OFFS)
04/10/2009**

PRELIMINARY TASKS

- Select the transport container based on the Department of Transportation hazard classification and the packaging requirements specified in the Hazardous Materials Table.
- Perform moisture evaluation of waste material to be loaded into transport containers to determine the potential for releasing liquid.

PREPARATION OF BULK CONTAINERS FOR LOADING

- Transport containers must be inspected for any condition that may affect their safety or performance prior to each use.
- Dump trucks and roll-offs with doors must have gaskets installed at the tailgate or doors that when the tailgate or doors are closed the gasket is compressed sealing the tailgate or doors to assure package integrity and containment of materials. The gasket must be inspected prior to each use for overall integrity including positioning, damage such as holes or tears or debris which could prevent tight closure. Any deficiencies shall require replacement prior to use.
- An absorption pad shall be placed in the truck or roll-off bed. The pad specification shall be determined utilizing the data determined in the waste material moisture evaluation and must be capable of absorbing the liquid which could be released.
- An absorption log at the rear of the transport container along the bottom of the tailgate or rear doors.
- A minimum 6 mil poly liner shall be placed over the absorption pad and absorption log prior to loading.
- Determine the amount of waste that can be loaded into the transport container. (Subtract the unladen weight of the transport vehicle from the maximum licensed weight of the transport vehicle. NOTE: Do not load the maximum permissible load determined in the mathematical calculation to allow for variance in scales that may be utilized to weigh the loaded vehicle.)

LOADING AND CLOSING BULK CONTAINERS

- Waste material shall be loaded into the transport container in such a manner that does not compromise either the liner or container integrity.
- Do not load material above the height of the sides of the transport container.
- Close the poly liner over of the waste material prior to tarping the load.
- Close the transport container by putting a heavy roll tarp over the top of the transport container and secure the tarp by utilizing tie downs on all four sides.

**HEALTH AND SAFETY PLAN
FOR
LOCKHEED MARTIN CORPORATION
SOIL AND GROUNDWATER CHARACTERIZATION
MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND**



**TETRA TECH NUS, INC.
20251 Century Boulevard Suite 200
Germantown, Maryland 20874-7114**

JANUARY 2011

**HEALTH AND SAFETY PLAN
FOR
LOCKHEED MARTIN CORPORATION

SOIL AND GROUNDWATER CHARACTERIZATION
MARTIN STATE AIRPORT**

**701 WILSON POINT ROAD
MIDDLE RIVER, MARYLAND**

**Submitted by:
Tetra Tech NUS, Inc.
20251 Century Boulevard, Suite 200
Germantown, MD 20874**

JANUARY 2011

PREPARED UNDER THE SUPERVISION OF:



**MICHAEL MARTIN, P.G.
PROGRAM MANAGER
GERMANTOWN, MARYLAND**

PREPARED AND APPROVED BY:



**MATTHEW M. SOLTIS, CIH, CSP
CORPORATE HEALTH AND SAFETY MANAGER
PITTSBURGH, PENNSYLVANIA**

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1.0 INTRODUCTION

This Health and Safety Plan (HASP) has been developed to provide the minimum practices and procedures for Tetra Tech NUS, Inc. (Tetra Tech) and subcontractor personnel engaged in the Martin State Airport at the Lockheed Martin Corporation (LMC), in Middle River, Maryland.

This HASP must be used in conjunction with the Tetra Tech Health and Safety Guidance Manual (HSGM). The HSGM contains Tetra Tech Health and Safety Standard Operating Procedures (SOPs), as well as detailed reference information on a variety of topics referenced in this HASP. This HASP and the contents of the Guidance Manual were developed to comply with the requirements stipulated in 29 CFR 1910.120 (OSHA's Hazardous Waste Operations and Emergency Response Standard) and applicable sections of 29 CFR 1926 (Safety and Health Regulations for Construction).

All contractor responsibilities stipulated in Section 1 of the Lockheed Martin Remediation Contractor's ESH Handbook (LM Handbook) will be adhered to. The LM Handbook can be found in Attachment I of this HASP.

Copies of all pertinent environmental, safety and health (ESH) records must be maintained at the job site. This includes, but is not limited to, this site-specific HASP, the Tetra Tech Health and Safety Guidance Manual, personnel training documentation, evidence of enrollment in a medical surveillance program, accident/injury reporting, work area inspections, periodic safety meetings, MSDS's, air monitoring data, waste container inspections, etc. These records must also be provided electronically to the Lockheed Martin Project Lead.

This HASP has been developed using the latest available information regarding known or suspected chemical contaminants and potential physical hazards associated with the proposed work and site. The HASP will be modified if the scope of work changes or if new information regarding site conditions, hazards, or contaminants of concern becomes available. If deviations are encountered from the field work plan, the contractor shall A) notify to the Lockheed Martin Project Lead and B) suspend work to assess changes to the work plan(s) and the HASP. Changes to the work plan(s) and the HASP shall be reviewed by the Project Lead. Procedures addressing changes to this HASP as described in Section 6 of the LM Handbook (Attachment I) will be followed.

1.1 KEY PROJECT PERSONNEL AND ORGANIZATION

This section defines responsibilities for site safety and health for Tetra Tech employees conducting field activities under this field effort. All personnel assigned to participate in the field work have the primary

responsibility for performing all of their work tasks in a manner that is consistent with the Tetra Tech Health and Safety Policy, the health and safety training that they have received, the contents of this HASP, and in an overall manner that protects their personal safety and health and that of their co-workers. The following persons are the primary point of contact and have the primary responsibility for observing and implementing this HASP and for overall on-site health and safety.

- The Tetra Tech Project Manager (PM) is responsible for the overall direction and implementation of this HASP.
- The Field Operations Manager (FOL) manages field activities, executes the work plan, and enforces safety procedures as applicable to the work plan.
- The Project Health and Safety Officer (PHSO) is responsible for developing this HASP in accordance with applicable OSHA regulations. Specific responsibilities include:
 - Providing information regarding site contaminants and physical hazards.
 - Establishing air monitoring and decontamination procedures.
 - Assigning personal protective equipment based on task and potential hazards.
 - Determining emergency action procedures.
 - Identifying appropriate emergency contacts.
 - Stipulating training and medical surveillance requirements.
 - Providing standard work practices to minimize potential injuries and exposures associated with hazardous waste site work.
 - Modify this HASP, where and when necessary.
- The Site Safety Officer (SSO) supports site activities by advising the PM on the aspects of health and safety on site. These duties may include the following:
 - Coordinate health and safety activities with the FOL.
 - Select, inspect, implement, and maintain personal protective equipment.
 - Establish work zones and control points.
 - Implements air-monitoring program for onsite activities.
 - Verify training and medical status of onsite personnel status in relation to site activities.
 - Implements hazard communication, respiratory protection, and other associated safety and health programs as necessary.
 - Coordinates emergency services.
 - Provides site specific training for onsite personnel.
 - Investigates accidents and injuries (see Attachment II Incident Report Form)

- Provides input to the PHSO regarding the need to modify, this HASP, or other applicable health and safety associated documents as per site-specific requirements.
- Compliance with the requirements of this HASP are monitored by the SSO and coordinated through the Tetra Tech Health and Safety Manager (HSM).

Note: In some cases one person may be designated responsibilities for more than one position. For example, the FOL may also be responsible for the SSO duties. This action will be performed only as credentials, experience, and availability permits.

1.2 STOP WORK

ALL employees are empowered, authorized, and responsible to STOP WORK at any time when an imminent and uncontrolled safety or health hazard is perceived. In a Stop Work event (immediately after the involved task has been shut down and the work area has been secured in a safe manner) the employee shall contact the Project Manager and the Corporate Health and Safety Manager. Through observations and communication, all parties involved shall then develop, communicate, and implement corrective actions necessary and appropriate to modify the task and to resume work.

1.3 SITE INFORMATION AND PERSONNEL ASSIGNMENTS**Site Name:** Martin State Airport Lockheed Martin**Address:** Middle River, Maryland**LMC Contact:** Tom Blackman **Phone Number:** (240) 460-7508**Proposed Dates of Work:** January 2011 until completion**Project Team:**

Tetra Tech Management Personnel:	Discipline/Tasks Assigned:	Telephone
<u>Michael Martin, P.G.</u>	<u>Project Manager (PM)</u>	<u>(301) 528-3022</u>
<u>Tony Apanavage</u>	<u>Field Manager</u>	<u>(301)-528-3021</u> <u>(301)-233-82</u>
<u>TBD</u>	<u>Site Safety Officer (SSO)</u>	<u></u>
<u>Matthew M. Soltis, CIH, CSP</u>	<u>Health and Safety Manager</u>	<u>(412) 921-8912</u>
<u>Clyde J. Snyder</u>	<u>Project Health and Safety Officer (PHSO)</u>	<u>(412) 921-8904</u>
<u>TBD</u>	<u>*Excavation Competent Person</u>	<u>TBD</u>

* MUST BE FILLED OUT PRIOR TO BEGINNING WORK

Non-Tetra Tech Personnel Telephone	Affiliation/Discipline/Tasks Assigned
<u></u>	<u></u>
<u></u>	<u></u>
<u></u>	<u></u>

Hazard Assessment (for purposes of 29 CFR 1910.132) for HASP preparation has been conducted by:

Prepared by: Clyde J. Snyder and Jennifer Carothers, PhD

2.0 EMERGENCY ACTION PLAN

2.1 INTRODUCTION

This section has been developed as part of a planning effort to direct and guide field personnel in the event of an emergency. In the event of an emergency, the field team will primarily evacuate and assemble to an area unaffected by the emergency and notify the appropriate local emergency response personnel/agencies. Workers who are ill or who have suffered a non-serious injury may be transported by site personnel to nearby medical facilities, provided that such transport does not aggravate or further endanger the welfare of the injured/ill person. The emergency response agencies listed in this plan are capable of providing the most effective response, and as such, will be designated as the primary responders. These agencies are located within a reasonable distance from the area of site operations, which ensures adequate emergency response time.

Tetra Tech personnel may participate in minor event response and emergency prevention activities such as:

- Initial fire-fighting support and prevention
- Initial spill control and containment measures and prevention
- Removal of personnel from emergency situations
- Provision of initial medical support for injury/illness requiring only first-aid level support
- Provision of site control and security measures as necessary

2.2 EMERGENCY PLANNING

Through the initial hazard/risk assessment effort, emergencies resulting from chemical, physical, or fire hazards are the types of emergencies which could be encountered during site activities. To minimize or eliminate the potential for these emergency situations, pre-emergency planning activities will include the following (which are the responsibility of the SSO and/or the FOL):

- Coordinating with Lockheed Martin MSA and/or local emergency response personnel to ensure that Tetra Tech emergency action activities are compatible with existing emergency response procedures.
- Establishing and maintaining information at the project staging area (support zone) for easy access in the event of an emergency. This information will include the following:
 - Chemical Inventory (of chemicals used onsite), with Material Safety Data Sheets.
 - Onsite personnel medical records (Medical Data Sheets).

- A log book identifying personnel onsite each day.
- Hospital route maps with directions (these should also be placed in each site vehicle).
- Emergency Notification - phone numbers.

The Tetra Tech FOL will be responsible for the following tasks:

- Identifying a chain of command for emergency action.
- Educating site workers to the hazards and control measures associated with planned activities at the site, and providing early recognition and prevention, where possible.
- Periodically performing practice drills to ensure site workers are familiar with incidental response measures.
- Providing the necessary equipment to safely accomplish identified tasks.

2.3 EMERGENCY RECOGNITION AND PREVENTION

2.3.1 Recognition

Emergency situations that may be encountered during site activities will generally be recognized by visual observation. Visual observation will also play a role in detecting potential exposure events to some chemical hazards. To adequately recognize chemical exposures, site personnel must have a clear knowledge of signs and symptoms of exposure associated with the principle site contaminants of concern as presented in this HASP. Tasks to be performed at the site, potential hazards associated with those tasks and the recommended control methods are discussed in detail in Sections 5.0 and 6.0. Additionally, early recognition of hazards will be supported by daily site surveys to eliminate any situation predisposed to an emergency. The FOL and/or the SSO will be responsible for performing surveys of work areas prior to initiating site operations and periodically while operations are being conducted. Survey findings are documented by the FOL and/or the SSO in the Site Health and Safety logbook, however, site personnel will be responsible for reporting hazardous situations. Where potential hazards exist, Tetra Tech will initiate control measures to prevent adverse effects to human health and the environment.

The above actions will provide early recognition for potential emergency situations, and allow Tetra Tech to instigate necessary control measures. However, if the FOL and the SSO determine that control measures are not sufficient to eliminate the hazard, Tetra Tech will withdraw from the site and notify the appropriate response agencies listed in Table 2-1.

2.3.2 Prevention

Tetra Tech and subcontractor personnel will minimize the potential for emergencies by following the Health and Safety Guidance Manual and ensuring compliance with the HASP and applicable OSHA regulations. Daily site surveys of work areas, prior to the commencement of that day's activities, by the FOL and/or the SSO will also assist in prevention of illness/injuries when hazards are recognized early and control measures initiated.

2.3.3 Fire Prevention / Flammable Liquids

Tetra Tech and subcontractor personnel are responsible for fire protection in all of their work areas at all times during the duration of this field effort (24 hours per day/seven days per week). Approved fire-fighting equipment and extinguishers, in adequate quantities for their work activates must be provided.

The Lockheed Martin Project Lead will be notified as soon as possible of any fire, if Tetra Tech or subcontractor personnel use a Lockheed Martin fire extinguisher, and of any and all fires that are extinguished. In case of fire, Tetra Tech and subcontractor personnel will call 9-1-1.

All flammable and combustible liquids must be stored, dispensed and used in accordance with OSHA regulations and the Uniform Fire Code. Bonding and grounding of containers containing flammable liquids will be required.

All fire prevention/flammable liquids safety procedures and requirements stipulated in Section 3.15 of the LM Handbook (Attachment I) will also be adhered to.

2.4 EVACUATION ROUTES, PROCEDURES, AND PLACES OF REFUGE

An evacuation will be initiated whenever recommended hazard controls are insufficient to protect the health, safety or welfare of site workers. Specific examples of conditions that may initiate an evacuation include, but are not limited to the following: severe weather conditions; fire or explosion; monitoring instrumentation readings which indicate levels of contamination are greater than instituted action levels; and evidence of personnel overexposure to potential site contaminants.

In the event of an emergency requiring evacuation, personnel will immediately stop activities and report to the designated safe place of refuge unless doing so would pose additional risks. When evacuation to the primary place of refuge is not possible, personnel will proceed to a designated alternate location and remain until further notification from the Tetra Tech FOL. Safe places of refuge will be identified prior to the commencement of site activities by the SSO and will be conveyed to personnel as part of the pre-activities training session. This information will be reiterated during daily safety meetings. Whenever

possible, the safe place of refuge will also serve as the telephone communications point for that area. During an evacuation, personnel will remain at the refuge location until directed otherwise by the Tetra Tech FOL or the on-site Incident Commander of the Emergency Response Team. The FOL or the SSO will perform a head count at this location to account for and to confirm the location of site personnel. Emergency response personnel will be immediately notified of any unaccounted personnel. The SSO will document the names of personnel onsite (on a daily basis) in the site Health and Safety Logbook. This information will be utilized to perform the head count in the event of an emergency.

Evacuation procedures will be discussed during the pre-activities training session, prior to the initiation of project tasks. Evacuation routes from the site and safe places of refuge are dependent upon the location at which work is being performed and the circumstances under which an evacuation is required. Additionally, site location and meteorological conditions (i.e., wind speed and direction) may dictate evacuation routes. As a result, assembly points will be selected and communicated to the workers relative to the site location where work is being performed. Evacuation should always take place in an upwind direction from the site.

2.5 EMERGENCY CONTACTS

Prior to initiating field activities, personnel will be thoroughly briefed on the emergency procedures to be followed in the event of an accident. Table 2-1 provides a list of emergency contacts and their associated telephone numbers. This table must be posted where it is readily available to site personnel. Facility maps should also be posted showing potential evacuation routes and designated meeting areas.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite (See Attachment III). If an exposure to hazardous materials has occurred, provide hazard information from Table 6-1 to medical service personnel.

The Lockheed Martin Project Lead shall be contacted immediately in the event of a fatal or serious injury, and unpermitted environmental release, or any ESH incident that is likely to generate significant publicity or an adverse situation for Lockheed Martin. Detailed requirements are describe in Section 1.15 of the LM Handbook (Attachment I).

In the event of an emergency not requiring 9-1-1, LMC facility personnel should be contacted in the order presented on Table 2-1.

TABLE 2-1
EMERGENCY CONTACTS
LMC MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

AGENCY	TELEPHONE
EMERGENCY (Police, Fire, and Ambulance)	911
LMC Contact, Tom Blackman	(240) 460-7508
LMC Martin State Airport Site Contact, John Morgan	(410) 682-1328
Airport Operations Manager Charles M. Baublitz	(410) 682-8831
Director Al Pollard, A.A.E	(410) 682-8800
Mike Musheno	(410) 682-1315 (Office) (610) 656-4012 (Cell)
Major Peter Leobach	(410) 918-6486
Franklin Square Hospital	(443) 777-7000
Chemtrec	(800) 424-9300
National Response Center	(800) 424-8802
Poison Control Center	(800) 222-1222
WorkCare	(800) 229-3674
PM, Michael Martin	(301) 528-3022
HSM, Matthew M. Soltis, CIH, CSP	(412) 921-8912
PHSO, Clyde Snyder	(412) 921-8904
Miss Utility Maryland/DC	1-800-257-7777

2.6 EMERGENCY ROUTE TO HOSPITAL

Franklin Square Hospital

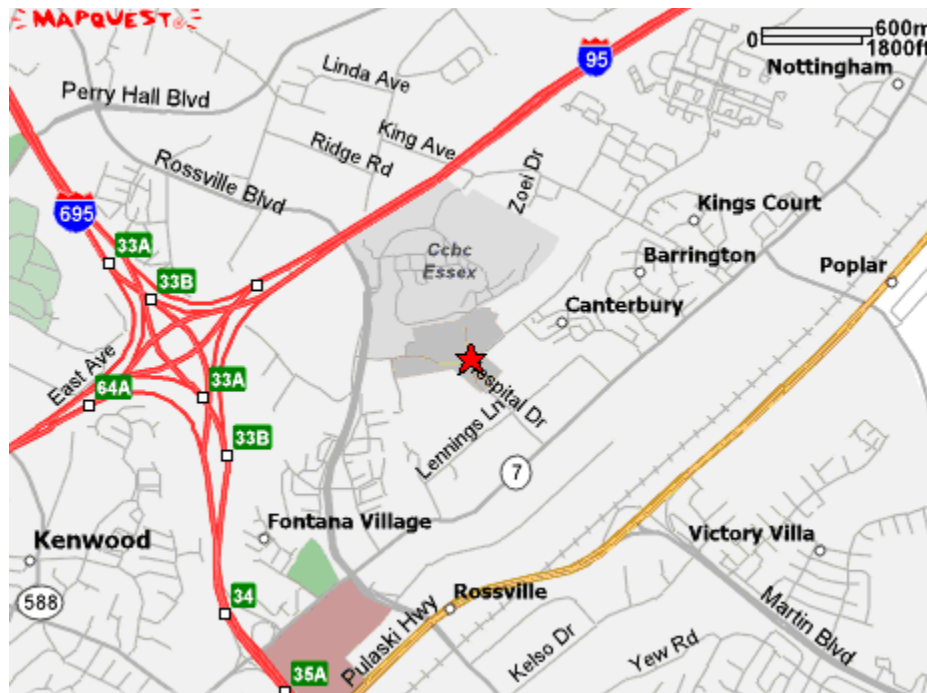
9000 Franklin Square Drive
Baltimore, Maryland 21237
(410) 682-7000

Driving Directions:

- 1) From Eastern Boulevard, take the Interstate 695.
- 2) Exit at exit number 34 (Philadelphia Road) and turn right.
- 3) Proceed on Philadelphia Road and turn left on Rossville Boulevard.
- 4) Proceed on Rossville Boulevard and take a right on Franklin Square Drive.
- 5) Proceed on Franklin Square Boulevard to 9000 and the hospital will be on the left hand side.

Routes and directions to the hospital are provided in Figure 2-1.

**FIGURE 2-1
ROUTE TO HOSPITAL**



2.7 EMERGENCY ALERTING AND ACTION/RESPONSE PROCEDURES

Tetra Tech personnel will be working in close proximity to each other at Lockheed Martin MSA. As a result, hand signals, voice commands, and line of site communication will be sufficient to alert site personnel of an emergency.

If an emergency warranting evacuation occurs, the following procedures are to be initiated:

- Initiate the evacuation via hand signals, voice commands, or line of site communication
- Report to the designated refuge point where the FOL will account for all personnel
- Once non-essential personnel are evacuated, appropriate response procedures will be enacted to control the situation.
- Describe to the FOL (FOL will serve as the Incident Coordinator) pertinent incident details.

In the event that site personnel cannot mitigate the hazardous situation, the FOL and SSO will enact emergency notification procedures to secure additional assistance in the following manner:

Dial 911 and call other pertinent emergency contacts listed in Table 2-1 and report the incident. Give the emergency operator the location of the emergency, the type of emergency, the number of injured, and a brief description of the incident. Stay on the phone and follow the instructions given by the operator. The operator will then notify and dispatch the proper emergency response agencies.

2.8 PPE AND EMERGENCY EQUIPMENT

A first-aid kit, eye wash units (or bottles of disposable eyewash solution) and fire extinguishers (strategically placed) will be maintained onsite and shall be immediately available for use in the event of an emergency. This equipment will be located in the field office as well as in each site vehicle. At least one first aid kit supplied with equipment to protect against bloodborne pathogens will also be available on site. Personnel identified within the field crew with bloodborne pathogen and first-aid training will be the only personnel permitted to offer first-aid assistance.

Safety eyewear meeting ANSI Z87.1 is required in areas designated as “Eye Projection Required” and is also required on all jobs where a potential injury to the eye is possible whether or not the area is posted.

Safety shoes and boots which meet the ANSI Z41 Standard shall be provided when impact and/or compression hazards exist.

Appropriate MSHA/NIOSH-approved respiratory protective devices must be worn when applicable state and/or federal action levels or OSHA permissible exposure levels are exceeded. Appropriate air

monitoring and respiratory protection equipment will be supplied and maintained if inhalation hazards are anticipated and a respiratory protection adhering to all state and federal regulations implemented.

Hearing protection must be worn in all areas posted to indicate high noise level or where employees are exposed to noise levels in excess of the OSHA action level (85 dBA over an 8-hour time-weighted average or a dose of fifty percent).

Protective clothing such as suits, aprons, boots or gloves shall be worn where there is a hazard to the body through dermal contact with chemicals, dusts, heat or other harmful agents or conditions.

Hard hats meeting the ANSI Z89.1 Standard will be worn in all areas where there is danger of impact to the head or hazard from falling or moving objects.

All personal protective clothing and equipment will be used and approved as detailed in Section 3.1 of the LM Handbook (Attachment I).

2.9 HAZARDOUS WASTE OPERATIONS AND EMERGENCY RESPONSE

Tetra Tech and subcontractor personnel conducting work at Lockheed Martin will adhere to Title 29, Code of Federal Regulations, Section 1910.120 – Hazardous Waste Operations and Emergency Response or the applicable state OSHA standards.

Tetra Tech and/or subcontractor personnel will perform periodic work area inspections to determine the effectiveness of the site safety and health plan and to identify and correct unsafe conditions in the work area. These inspections shall be documented and available to Lockheed Martin upon request for review.

The requirements and regulations described in Section 3.20 of the LM Handbook (Attachment I) will be adhered to.

2.10 DECONTAMINATION PROCEDURES / EMERGENCY MEDICAL TREATMENT

During any site evacuation, decontamination procedures will be performed only if doing so does not further jeopardize the welfare of site workers. Decontamination will be postponed if the incident warrants immediate evacuation. However, it is unlikely that an evacuation would occur which would require workers to evacuate the site without first performing the necessary decontamination procedures.

Tetra Tech personnel will perform rescue operations from emergency situations and may provide initial medical support for injury/illnesses requiring only "Basic First-Aid" level support, and only within the limits of training obtained by site personnel. Basic First-Aid is considered treatment that can be rendered by a

trained first aid provider at the injury location and not requiring follow-up treatment or examination by a physician (for example; minor cuts, bruises, stings, scrapes, and burns). Personnel providing medical assistance are required to be trained in First-Aid and in the requirements of OSHA's Bloodborne Pathogen Standard (29 CFR 1910.1030). Medical attention above First-Aid level support will require assistance from the designated emergency response agencies. Attachment II provides the procedure to follow when reporting an injury/illness, and the form to be used for this purpose.

2.11 INJURY/ILLNESS REPORTING

If any Tetra Tech personnel are injured or develop an illness as a result of working on site, the Tetra Tech "Incident Report Procedure" (Attachment II) must be followed. Following this procedure is necessary for documenting of the information obtained at the time of the incident.

Any pertinent information regarding allergies to medications or other special conditions will be provided to medical services personnel. This information is listed on Medical Data Sheets filed onsite. If an exposure to hazardous materials has occurred, provide information on the chemical, physical, and toxicological properties of the subject chemical(s) to medical service personnel.

Tetra Tech personnel will contact the LMC personnel in the order presented in Table 2-1 in the event of a fatality injury, environmental release (spill), near-miss incident, or an ESH incident that is likely to generate significant publicity. A written report of the incident/injury/spill and corrective action(s) must be submitted to LMC personnel within one (1) day of the incident.

Section 8.1 of the LM Handbook (Attachment I) describing the requirements of accident, injury, illness and incident reporting will be addressed.

2.10.1 TOTAL Incident Reporting System

TOTAL is Tetra Tech's new online incident reporting system. Use TOTAL to directly report health and safety incidents, notify key personnel, and initiate the process for properly investigating and addressing the causes of incidents, including near-miss events. An incident is considered any unplanned event. It may include several types of near misses, events where no loss was incurred, or incidents that resulted in injuries or illness, property or equipment damage, chemical spills, fires, or damage to motor vehicles.

TOTAL looks like the incident reporting form in Attachment II. TOTAL is an intuitive system that will guide you through the necessary steps to report an incident within 24 hours of its occurrence. Behind the scenes, TOTAL is a powerful tool for H&S professionals, and will help Tetra Tech to better track incidents, analyze root causes, implement corrective action plans, and share lessons learned. The ultimate result is a more safe and healthy working environment for us all.

TOTAL is maintained on the Tetra Tech Intranet site at <https://my.tetrattech.com/>

Once on the “My Tetrattech” site, TOTAL can be found under the Health and Safety tab, Incident Reporting section, select “Report an Incident (TOTAL)”. This will connect you directly to TOTAL. TOTAL can also be accessed directly from the internet using the following web address: <http://totalhs.tetrattech.com/>

Note: When using the system outside the Tetra Tech intranet system or when operating in a wireless mode, a VPN connection will be required. The speed of the application may be affected dependent upon outside factors such as connection, signal strength, etc. Enter the system using your network user name and password. The user name should be in the following format - TT\nickname.lastname.

2.11 DRILL/INCIDENT AFTER ACTION CRITIQUE

The FOL will conduct a drill or exercise to test the Emergency Action Plan. A critique with the site personnel after each drill or incident will be conducted. This critique provides a mechanism to review the incidents and exercises or drills to determine where improvements can be made. For incidents recorded in TOTAL, the FOL will utilize the Lessons Learned component for the critique.

3.0 SITE BACKGROUND

3.1 SITE HISTORY

The LMC MRC is located at 2323 Eastern Boulevard in Middle River, Maryland. The site consists of approximately 180 acres of land and twelve main buildings. The subject property also includes perimeter parking lots, an athletic field, Lot D (presently a vacant lot with a concrete foundation for former Building D), a trailer and parts storage lot, and a vacant waterfront lot. The site is bounded by Eastern Boulevard (Route 150) to the north, Dark Head Creek to the south, Cow Pen Creek to the west, and Martin State Airport to the east.

The Martin State Airport (MSA) is located at 701 Wilson Point Road in Middle River, Maryland, and is bounded by Frog Mortar Creek to the east and Stansbury Creek to the west. Both creeks join into Chesapeake Bay to the south of the airport. With surface water bodies surrounding most of MSA, the site can be considered a small peninsula.

Historically, MSA was owned and operated by the Glenn L. Martin Company from approximately 1929 to 1975. Glenn L. Martin Company is the predecessor to Martin Marietta; Lockheed and Martin Marietta merged in 1996 to form Lockheed Martin Corporation. Since the 1950's the Maryland Air National Guard has leased land at the northeastern portion of the airport just north of the MSA site being investigated by LMC. In 1975, the airport was sold to the Maryland Aviation Administration (MAA), an agency within the Maryland Department of Transportation.

Currently, LMC is completing voluntary investigations conducted under the Maryland Department of the Environment (MDE) Environmental Restoration and Redevelopment program on a 50 acre portion of the MSA. This study is in support of the characterization of the 50 acre area.

Martin State Airport is an active airport, operated by the Maryland Aviation Administration. It is comprised of 747 acres, and is described by the MAA as a General Aviation Reliever Airport.

3.2 STRAWBERRY POINT AND GREATER STRAWBERRY POINT FACILITY

Strawberry Point (SP) is located within the confines of the MSA at the southern tip of the peninsula between the confluence of Stansbury Creek and Frog Mortar Creek. SP can be accessed from Eastern Avenue by traveling on Wilson Point Road and entering through a secured unmanned gate. The previously investigated, SP wooded area is located at the southwest terminus of the peninsula and covers approximately 25 acres. The wooded area is bounded by earthen berms near the water line with thick

brush and trees covering the entire area. Much of the SP wooded area was filled during the 1940's reportedly from deposition of dredge spoils from Stansbury Creek and Frog Mortar Creek. A locked gate controls the entrance to the wooded area. The remainder of the area is currently being investigated, referred to as GSP, is a cleared and partially developed 75-acre area that houses a seaplane ramp, hangar, tank farm, police building and other maintenance buildings extending from the southern end of peninsula to the northern end bordering Taxiway J and eastward from Stansbury Creek to the Taxiway F. The airport runway is located northeast of the GSP.

Greater Strawberry Point was leased from the Glenn L. Martin Company by the Department of Navy on December 23, 1943. At that time, the Navy used the facility and the supporting structures, including a large hangar, for seaplane maintenance, launching, and recovery operations. During Navy occupancy, the former hangar and surrounding GSP area was known as the Naval Weapons Industrial Reserve Plant No. 148. Beginning on December 16, 1963, the Air Force occupied the facility (Permit No.1-N-MD-714) for a brief period. During the Department of Defense (DOD) usage (Navy and Air Force operations), the southern portion of the GSP near the wooded portion of the site contained more than 10 buildings. These included the Beach House (Building No. 3), the Pumping Station (Building No. 4), the Chlorination Station (Building No. 5), two Power Fence Service Houses (Building No. 6 and No. 9), Solvent Storage (Building No. 7), Equipment Storage Building (Building No. 8), Power Fence Switch House (Building No. 10), Delivery Hangar (Building ND/No. 11), and a general Storage Building (Building No. 12). A tank farm containing aboveground storage tanks (ASTs), used for the storage of aircraft fuels, was located adjacent to the wooded area near the southernmost tip of the developed area.

During the same time period (1940s to 1960s), the northern portion of greater GSP was developed with several improvements related to the Naval weapons research. These structures included the Induction Test Building (Building No. 13), Control House (Building No. 14), Noise Suppression Building (Building No. 15), Jet Test Shed (Building No. 16), Storage Building (Building No. 17), Propulsion Test Building (Building No. 22), Compressor Shed (Building No. 23), Engine Test Building (Building No. 24), and Vibration Sloss Test Building (near location of current ground surface mounding). A missile testing area was located along a straight road northwest of the Propulsion Test Building that included the Hyper-therm Test Facility (Building No. 25), Propellant Storage Shed (Building No. 18), Furnace Building (Building No. 19), Acetylene Storage Shed (Building No. 20), Vanguard Tower (Building No. 21), Block House (Building No. 26), and three Coupon Test Sheds (Building No. 27, No. 28, and No. 29).

Further to the northwest, along a former dirt road connecting Strawberry Point Road to the historic airfield maintenance storage building (Building No. 37), several buildings dedicated to nuclear research and testing were constructed. Two main research buildings were designated as the Critical Test Building (Building No. 36/Building. KC) and the Radioisotope Lab (Building No. 35/Building KJ). These research

labs operated under Nuclear Regulatory Commission (NRC) permits. These buildings were decontaminated in the late 1980s and NRC terminated the licenses in 1995. A third building was located just south of the labs and was known as the Liquid Metal Test Facility (Building No. 34). Additional buildings near the nuclear labs included several sheds that were removed by Martin-Marietta Corporation to construct Taxiway J, including an organic material storage shed.

Available records indicate that two underground storage tanks (USTs) were installed during DOD's usage of the southern GSP facilities. A 10,000-gallon, heating oil UST was located adjacent to the hangar (Building ND) to provide fuel to the hangar's heating system. This UST was closed-in-place in 1987 (post-DOD period) as the hangar's heating system was converted from fuel oil to natural gas. Both the lease and permit expired on November 30, 1967.

Just prior to that date, the Glenn L. Martin Company merged with Marietta Corporation to form Martin-Marietta Corporation. On June 30, 1975, MSA was conveyed to the MDOT. The State of Maryland currently uses MSA to house and maintain Medivac Units and Helicopters. The southern portion of GSP is occupied by the Baltimore County Marine Police. Eleven USTs have been removed from MSA since 1983 and no evidence of leakage was reported. The large hangar (designated as Building ND) was demolished in 1989, and another hangar that currently houses the Maryland State Police was constructed in 1989 and 1990. GSP currently contains a tank farm consisting of 12 ASTs containing jet fuel, fuel oil, and gasoline along with a pump house and other ancillary buildings currently used by the airport. In addition, as many as six ASTs present at the tank farm are in use by other tenants. An oil spill was reported during the construction of the new hangar in 1989 and 1990, when a fuel oil return and receiving line to two 12,000-gallon ASTs located in the tank farm was severed.

4.0 SCOPE OF WORK

This section summarizes the specific tasks that are to be conducted as part of this scope of work and covered by this HASP. Any modifications (additions, or substantive changes) to these specified tasks will be a change in scope, which will require a review and appropriate modification of this HASP. In such an event, the PM is responsible for communicating the nature of the change to the HSM prior to the initiation of any onsite activity associated with the scope of work change. The HSM is then responsible for assuring that appropriate changes to this HASP are made.

The planned tasks covered by this HASP include the following:

- Mobilization/demobilization activities
- Soil lithology and groundwater assessment using Cone Penetrometer Testing (CPT) equipped with a Membrane Interface Probe (MIP)
- Confirmatory Direct Push Technology (DPT) soil and groundwater assessment
- Installation and development of groundwater monitoring wells and well points via Direct Push Technology
- Surveying new monitoring wells
- Multi-media Sampling
 - Groundwater Samples
 - Soil Samples
 - Sediment Samples
 - Storm Water Samples
- Wetland Survey
- Concrete Coring
- Passive Soil Gas survey
- Aquifer pump testing
- Geophysical Surveying

- Test pit excavation and soil sampling
- Decontamination of heavy equipment and sampling equipment
- IDW Management

For more detailed description of the planned tasks associated with LMC MSA, refer to the Work Plan (WP). Any tasks to be conducted outside of the elements listed here will be considered a change in scope requiring modification of this document. All requested modifications to this document will be submitted to the HSM by the PM or a designated representative.

No other activities are anticipated to be necessary. If it becomes apparent that additional or modified tasks must be performed beyond those listed above, the work is not to proceed until the FOL or SSO notifies the Project Manager and the HSM, so that any appropriate modifications to this HASP can first be developed and communicated to the intended task participants.

5.0 IDENTIFYING AND COMMUNICATING TASK-SPECIFIC HAZARDS AND SAFE WORK PRACTICES

The purpose of this section is to identify the anticipated hazards and appropriate hazard prevention/hazard control measures that are to be observed for each planned task or operation. These topics have been summarized for each planned task through the use of task-specific Safe Work Permits (SWPs), which are to be reviewed in the field by the SSO with all task participants prior to initiating any task. Additionally, potential hazard and hazard control matters that are relevant but are not necessarily task-specific are addressed in the following portions of this section.

Section 6.0 presents additional information on hazard anticipation, recognition, and control relevant to the planned field activities.

In the event of an emergency, not requiring 911, LMC facility personnel should be contacted in the order presented on Table 2-1.

5.1 GENERAL SAFE WORK PRACTICES

In addition to the task-specific work practices and restrictions identified in the SWPs (Attachment IV) the following general safe work practices are to be followed when conducting work on-site.

- Eating, drinking, chewing gum or tobacco, taking medication, or smoking in contaminated or potentially contaminated areas or where the possibility for the transfer of contamination exists is prohibited.
- Wash hands and face thoroughly upon leaving a contaminated or suspected contaminated area. If a source of potable water is not available at the work site that can be used for hands-washing, the use of waterless hands cleaning products will be used, followed by actual hands-washing as soon as practicable upon exiting the site.
- Avoid contact with potentially contaminated substances including puddles, pools, mud, or other such areas. Avoid, kneeling on the ground or leaning or sitting on equipment. Keep monitoring equipment away from potentially contaminated surfaces.
- Plan and mark entrance, exit, and emergency evacuation routes.
- Rehearse unfamiliar operations prior to implementation.

- Buddies should maintain visual contact with each other and with other on-site team members by remaining in close proximity to assist each other in case of emergency.
- Establish appropriate safety zones including support, contamination reduction, and exclusion zones.
- Minimize the number of personnel and equipment in contaminated areas (such as the exclusion zone). Non-essential vehicles and equipment should remain within the support zone.
- Establish appropriate decontamination procedures for leaving the site.
- Immediately report all injuries, illnesses, and unsafe conditions, practices, and equipment to the SSO.
- Observe co-workers for signs of toxic exposure and heat or cold stress.
- Inform co-workers of potential symptoms of illness, such as headaches, dizziness, nausea, or blurred vision.

5.2 DRILLING (HSA/DPT/LITTLE BADGER UNIT/RTOSONIC) SAFE WORK PRACTICES

The following Safe Work Practices are to be followed when working near operating drilling equipment.

5.2.1 Before Drilling

- Identify underground utilities, buried structures, and aboveground utility lines before drilling. Tetra Tech NUS, Inc. personnel will use the Utility Locating and Excavation Clearance Standard Operating Procedure provided in the Tetra Tech Health and Safety Guidance Manual.
- Drill rigs will be inspected by the SSO or designee, prior to the acceptance of the equipment at the site and prior to the use of the equipment. Needed repairs or identified deficiencies will be corrected prior to use. The inspection will be accomplished using the Equipment Inspection Checklist provided in Attachment V. Additional inspections will be performed at least once every 10-day shift or following repairs.
- Check operation of the Emergency Stop/Kill Switch and/or the "Dead Man's" operational controls. These operational checks are required initially as part of the equipment pre-use inspection, and then periodically thereafter. Periodic checks are required at least weekly, or more frequently if recommended by the rig manufacturer.

- Ensure that machine guarding is in place and properly adjusted.
- Block drill rig and use out riggers/levelers to prevent movement of the rig during operations.
- The work area around the point of operation will be graded to the extent possible to remove any trip hazards near or surrounding operating equipment.
- The driller's helper will establish an equipment staging and lay down plan. The purpose of this is to keep the work area clear of clutter and slips, trips, and fall hazards. Mechanisms to secure heavy objects such as drill flights will be provided to avoid the collapse of stacked equipment.
- Potentially contaminated tooling will be wrapped in polyethylene sheeting for storage and transport to the centrally located equipment decontamination unit.
- Prior to each instance of engaging the HSA drill rig, the Driller will look to ensure that the drilling area is clear of personnel and obstructions, and verbally alert everyone in the area that the rig is about to be engaged.
- Prior to the start of boring operations, one individual will be designated as the person responsible for immediate activation of the emergency stop device (if applicable) in the event of an emergency. This individual will be made known to the field crew and will be responsible for visually checking the work area and verbally alerting everyone of boring operations prior to engaging the equipment.

5.2.2 During Drilling

- The Driller will ensure that an individual is constantly stationed at a location where the drill rig emergency stop switch can be immediately engaged.
- Minimize contact to the extent possible with contaminated tooling and environmental media.
- Support functions (sampling and screening stations) will be maintained a minimum distance from the drill rig of the height of the mast plus five feet or 35-feet for Rotosonic/HSA, 25-feet for DPT operations whichever is greater to remove these activities from within physical hazard boundaries.
- Only qualified operators and knowledgeable ground crew personnel will participate in the operation of the drill rig.

- During maintenance, use only manufacturer provided/approved equipment (i.e. auger flight connectors, etc.)
- In order to minimize contact with potentially contaminated tooling and media and to minimize lifting hazards, multiple personnel should move auger flights and other heavy tooling.
- Only personnel absolutely essential to the work activity will be allowed in the exclusion zone.

5.2.3 After Drilling

- Equipment used within the exclusion zone will undergo a complete decontamination and evaluation by the SSO to determine cleanliness prior to moving to the next location, exiting the site, or prior to down time for maintenance.
- Motorized equipment will be fueled prior to the commencement of the day's activities. During fueling operations equipment will be shutdown and bonded to the fuel source.
- When not in use drill rigs will be shutdown, and emergency brakes set and wheels will be chocked to prevent movement.
- The mast will be completely lowered and outrigger completely retracted during movement to decontamination or the next location.
- Areas subjected to subsurface investigative methods will be restored to equal or better than original condition. Any contamination that was brought to the surface by drilling or DPT operations will be removed and containerized. Physical hazards (debris, uneven surfaces, ruts, etc.) will be removed, repaired or otherwise corrected. In situations where these hazards cannot be removed these areas will be barricaded to minimize the impact on field crews working in the area.

5.2.4 Concrete Coring Operations

The following safe work practices will be employed during concrete coring operations:

- The coring machine will be inspected to insure housings; plugs; guards are intact, and the coring machine is in good operating order.

- If the power source to be employed is not through a Ground Fault Circuit Interrupter (GFCI) then a temporary GFCI plug extension shall be put in place.
- A shop vac or similar device also connected to the GFCI will be used to collect the water employed during the coring process. All water in the coring area will be cleaned to reduce the potential for slip, trip and falls. Place floor wet signs as necessary from all approach venues.
- The preferred method is to bolt the coring machine to the floor during coring operations. It is however acceptable to utilize sand bags or similar weighted devices to control movement during this activity.
- No open core holes will be permitted after the termination of the shift. All cores will be placed back in the holes or the holes will be fitted for their permanent casings for the sub-slab soil gas vapor monitoring points.
- All core holes finished with protective casings or finished using concrete will be finished to grade again to prevent slip, trips, and/or falls.

5.3 EXCAVATION –SAFE WORK PRACTICES

See Section 16.0 of this HASP.

5.4 PERMANENT SOIL GAS VAPOR MONITORING POINTS WITHIN BUILDINGS

If installation of permanent soil gas vapor monitoring points is conducted within buildings on site, soil gas monitoring points may need to be installed at various locations using a diesel powered DPT rig. If necessary, a gasoline or electric powered concrete coring machine may be used if the DPT rig cannot push through the concrete floor.

Operation of diesel/gasoline powered equipment within enclosed areas such as buildings presents unique hazards particularly the inhalation of exhaust gasses, fumes, and dusts generated during concrete coring or soil boring. Additional hazards that may be present during these operations include, increased noise levels, contact with utilities, electrocution hazards (particularly if water is present), and the movement of heavy equipment.

The major gaseous products of both diesel and gasoline fueled engines are carbon monoxide and water, but lower percentages of carbon monoxide, sulfur dioxide, and nitrogen dioxides as well as low molecular weight hydrocarbons and their derivatives are also formed. Submicron-size particles are present in the exhaust emissions of internal combustion engines. The particles present in diesel engine exhaust are

composed mainly of elemental carbon, absorbed organic material, and traces of metallic compounds. The particles emitted from gasoline engines are composed primarily of metallic compounds, elemental carbon and adsorbed organic material. However, the composition and quantity of the emissions from an engine depend mainly on the type and condition of the engine, fuel composition and additives, operating conditions, and emission control devices.

Short-term (acute) effects of workers exposed to high concentrations of exhaust gasses/fumes may include irritation of the eyes, nose, and throat; lightheadedness; heartburn; headache; weakness, numbness and tingling in the extremities; chest tightness; wheezing; and vomiting. Although there have been relatively few studies on the long-term health effects of exhaust gasses/fumes, the available studies indicate that they can be harmful to your health. According to the National Institute for Occupational Safety and Health (NIOSH), human and animal studies show that diesel/gasoline exhaust should be treated as a human carcinogen. Exposure to diesel/gasoline exhaust in combination with other cancer causing substances may increase your risk of developing lung or other forms of cancer. Some studies have suggested that workers exposed to diesel/gasoline exhaust are more likely to have chronic respiratory symptoms such as persistent cough and mucous, bronchitis, and reduced lung capacity than unexposed workers.

The follow controls may be used to minimize potential exposures to exhaust gases/fumes:

- Use flexible tailpipe or stack exhaust hoses to vent equipment exhaust gases/fumes to the outside.
- Use of general ventilation (roof vents, open doors and windows, roof fans, rollup doors, floor fans, etc.) to move air through the work area to facilitate dilution of airborne exhaust gases/fumes. If exhaust gas/fume concentrations cannot be diluted with existing general ventilation methods, use local exhaust ventilation devices (portable axial blowers, coppus blowers) to vent exhaust gases/fumes to the outside.
- If feasible, use grade 1K diesel fuels which burns more clearly than Diesel 1 fuels.
- All equipment must have regular maintenance and frequent tune ups including checks of the exhaust system to determine if leaks exist. All equipment will be inspected using the Equipment Inspection Checklist provided in Attachment V.
- Prolonged idling of machinery should be avoided.

- Minimize the number of personnel in the area where internal combustion engines are operating. Observe workers for signs and symptoms of exposure.
- Monitor the work area for airborne concentrations of carbon monoxide which will be used to control exposures to carbon monoxide and other exhaust gases – follow established action levels.
- Use wetting methods to suppress airborne dusts generated during concrete coring or soil boring within the building.

5.5 HAND AND POWER TOOL SAFE WORK PRACTICES

The following safe work practices will be employed during hand and power tool usage:

- All hand and power tools will be maintained in a safe condition.
- Electrical power tools shall be grounded or double insulated with proper assured equipment grounding inspections or Ground Fault Interrupter (GFI) circuit protection provided.
- Pneumatic power tools shall be secured to the hose or whip by some positive means.
- Only properly trained Contractor employees shall operate power-actuated tools.
- All grinding machines shall conform to OSHA and ANSI requirements.

Hand and power tool use procedures are detailed in Section 3.16 of the LM handbook and will be followed.

5.6 HOUSEKEEPING / CLEANUP

Housekeeping procedures described in Section 5 of the LM Handbook (Attachment I) will be addressed and the following housekeeping practices will be employed during this field effort:

- Ensure discharge permits and/or Stormwater Pollution Prevention Plans (if applicable) are available at the project job site.
- Tetra Tech and/or subcontractor personnel will clean up its respective work area(s) and maintain work areas free from all slip, trip, and fall hazards at all times.

- Debris shall be kept cleared from work areas, passageways, stairs, and in and around buildings or other structures. The work area must be left free from accumulation of waste and rubbish at the end of each work shift.
- Combustible scrap and debris shall be removed at regular intervals during the course of work. Safe means shall be provided to facilitate such removal.
- At the end of each working day and/or the conclusion of work being performed, the work area will be restored to the same degree of neatness as when work commenced.
- Tetra Tech and/or subcontractor will furnish necessary equipment and/or receptacles to remove waste and rubbish from the job site unless otherwise specified by Lockheed Martin.

5.7 WATER HAZARDS

- Planned activities involve locations that are near bodies or on bodies of water. Sampling activities will be conducted from a flat bottom motor boat. Other tasks, such as depth measurement, will be conducted from a canoe. To avoid potential hazards associated with working near water (drowning), the field team shall employ lifelines (tie-off procedure), safety harnesses, when within 4 feet of the water's edge. When working out of a canoe or other boat, U.S. Coast Guard (USCG) approved personal flotation devices (PFD) will be used. Due to the obvious hazards associated with working on or near water's edge during inclement weather, all field activities may be temporarily suspended or terminated at the discretion and direction of the FOL or SSO.

5.7.1 U.S.C.G. Flotation Device Types

- Use the following information to determine the proper type of U.S.C.G. PFD.
- Off Shore Life Jacket (type I, 22lbs buoyancy)
- Type I life jacket is the best choice for rough or open waters. This type will float you the best and is favorable if rescue may be long in coming. This type will turn an unconscious person upright in the water. Though is bulky it does have a highly visible color for easier detection.
- Near Shore Buoyant Vest (Type II, 15.5lbs buoyancy)

- Type II is a good choice for calmer waters. It will turn most unconscious persons face-up in the water. Though it is less bulky than Type I, it is not intended for long hours in calm or rough water.
- Flotation Aid (Type III, 15.5lbs buoyancy)
- Type III is probably the most comfortable device offering more freedom of movement, such as water skiing or fishing, but is not intended for rough water. Also, an unconscious person may end up face-down in the water.
- Throwable Devices (Type IV)
- Throwable devices are intended for calm waters with heavy boat traffic where help is always close. It is not intended for unconscious persons or non-swimmers or long hours in the water. They are good backups for the other devices.

5.7.2 U.S.C.G Boat Regulations

- A flat bottom (Jon) boat can be used to collect the surface and sediment samples. These boats generally have a shallow draft and can get up on plane easily but unless the water surface is perfectly calm they tend to give a rough ride because of the flat bottom pounding on each wave. They also tend to be less stable and require careful balancing of cargo and crew. The U.S.C.G. requires these types of boats to have the following equipment on board:
 - One personal flotation device per person
- A sound producing device such as an air horn or whistle which can be heard one half mile.

5.7.3 Strain/Muscle Pulls from Heavy Lifting

- During execution of planned activities there is some potential for strains, sprains, and/or muscle pulls due to the physical demands and nature of this site work. To avoid injury during lifting tasks personnel are to lift with the force of the load carried by their legs and not their backs. When lifting or handling heavy material or equipment use an appropriate number of personnel. Keep the work area (e.g., inside of boat) free from clutter to avoid unnecessary twisting or sudden movements while handling loads.

5.7.4 Proper Canoe Lifting and Carrying Techniques

- Some tasks such as depth level determination may be taken from a canoe. Therefore, it is important to know how to transport a canoe to and from the water. This includes carrying the canoe by hand and transporting it on your vehicle.
 - Lift the canoe with another person (or persons) whenever possible. Canoes are often carried by single individuals, but lifting is almost always easier with more than one person. Empty the canoe of all water and equipment before you lift it. Extra weight is harder to lift and it can damage the hull. Lift using the muscles in your legs as much as possible, keeping your back straight and your knees bent. Lifting and carrying techniques designed for two or more people require communication and coordination.
 - Two-person lifts and carries are commonly used to carry boats short distances or to lift them up onto roof-top car racks.
- The Underhand Lift And Carry
 - To carry the canoe a short distance, use a basic underhand lift. Stand on the opposite side and opposite end of the canoe from your partner. Grab the closest carrying handle or gunwale edge with your boat-side hand (while your partner does the same) and lift straight upwards. Don't use your boat's deck plates for lifting unless they have a built-in carrying handle.
 - Face in the direction of travel so you can see where you're going and avoid obstacles in your path. Communicate with your partner, so they know if you need to stop and set the canoe down. The person in front should act as the eyes for the rear person, warning them of any obstacles in the path.
- The Overhead Lift And Carry
 - When transporting the canoe over longer distances, you can reduce arm and shoulder strain by carrying the boat overhead on your shoulders. The following lift procedure can also be used when lifting a canoe to place it on a roof-top car rack:
 - Begin by standing at the opposite end (but the same side) of the canoe as your partner, both of you facing the boat.

- Grab both gunwales (one in each hand) just in front of the seat closest to you. Have your partner do the same. Make sure your hand closest to the bow is on the far gunwale, while your hand closest to the stern is on the near gunwale.
- Working in conjunction with your partner, lift upwards simultaneously (being careful to lift with your legs and keep your backs as straight as possible) until the boat is resting right-side-up against your thighs.
- Pause briefly to make sure your partner is ready to proceed, then lift and roll the canoe up over your heads in a single, smooth motion, using one thigh to thrust the canoe hull upwards if necessary. NOTE: You may find that cupping the hull of the canoe with your stern-side arm as you rotate it helps you control the boat.
- Once the canoe is directly overhead, carefully lower the boat until the gunwales are resting comfortably on your (and your partner's) shoulders.
- The two-person overhead carry is most effective when the ground is relatively flat and the distance to be covered is not too long. On rough terrain and long trails, it can be somewhat difficult to stay coordinated.
- The two-person overhead technique can also make seeing the trail ahead somewhat difficult, especially if the person in front is the same size or shorter than the rear person. If this is the case, the front person may wish to scoot forward until they can rest the deck of the canoe on one shoulder or the other, so that their head is not under the hull.

5.8 WETLAND SAFE WORK PROCEDURES

This investigation entails a wetland survey to conduct work safely field crews will know the wetland where the survey is being conducted:

- Depth of water in area where survey is being conducted
- Species (both plant and animal) that could be encountered relevant to the body of water where the survey is being conducted.
- Protective equipment required for a survey including:
 - Ranging pole to check water depths and bottom surface configuration in murky waters
 - Life jacket as specified in Section 5.7

- Chest waders
- Binoculars
- Workers will work in groups of no less than two people for safety
- Notify the guard station or site contact when working in or near water. In the event of an emergency site personnel are required to have a contact and or control point.

This wetland survey may possibly be performed from a water craft. In order to avoid potential hazards associated with working on water (drowning), the field team will follow the safety procedures outlined in Section 5.7 of this HASP

6.0 HAZARD ASSESSMENT AND CONTROLS

This section provides information regarding the chemical, physical, and natural hazards associated with the sites to be investigated and the activities that are to be conducted as part of the scope of work. Table 6-1 provides information on potential chemical contaminants, including exposure limits, symptoms of exposure, physical properties, and air monitoring and sampling data.

6.1 CHEMICAL HAZARDS

Previous investigations indicate that the contaminants of concern are Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs) and Metals but are present in relatively low concentrations. Exposure to site personnel via inhalation is considered low.

6.1.1 Volatile Organic Compounds (VOCs)

The majority of VOCs are often related to chlorinated solvents and associated degradation products, paint thinners, dry cleaning solvents, constituents of petroleum fuels (e.g. gasoline and natural gas), and crude oil tanking. Symptoms of exposure to VOCs can include abdominal pain, irritation of the skin, eyes, nose, and throat, dizziness, tremors, vomiting, GI bleeding, enlarged liver, pallor of the extremities, and frostbite like-symptoms.

Short-term exposure to VOCs, such as TCE and VC, can cause irritation of the nose and throat and central nervous system (CNS) depression, with symptoms such as drowsiness, dizziness, giddiness, headache, loss of coordination. High concentrations have caused numbness and facial pain, reduced eyesight, unconsciousness, irregular heartbeat and death. Very high concentrations have produced death due to CNS effects, and, in rare cases, irregular heart beat. Permanent nervous system damage and/or liver injury have resulted from severe overexposure.

6.1.2 Semi-Volatile Organic Compounds (SVOCs)

SVOCs are substances composed primarily of carbon and hydrogen atoms that have boiling points greater than 200 degrees C. Sites where halogenated SVOCs may be found include burn pits, chemical manufacturing plants and disposal areas, contaminated marine sediments, disposal wells and leach fields, electroplating/metal finishing shops, firefighting training areas, hangars/aircraft maintenance areas, landfills and burial pits, leaking collection and system sanitary lines, leaking storage tanks, radiologic/mixed waste disposal areas, oxidation ponds/lagoons, pesticide/herbicide mixing areas, solvent degreasing areas, surface impoundments, and vehicle maintenance areas and wood preserving sites.

Potential health effects related to SVOC exposure include organ system toxicity (non-reproductive), cancer, birth or developmental effects, brain and nervous system damage, and reproduction and fertility damage.

6.1.3 Metals

Specific toxicities and symptoms from metals vary between individual metal compounds and associated isomers. However, general toxicities exist that can be applied to the general category of metals. For example metals are considered kidney toxins. Other generalized effects have demonstrated impacts on the peripheral and central nervous systems, blood forming mechanisms, gastrointestinal disturbances, cardio and vascular toxicities and some are cancer causing agents. In a particulate form, metals will cause respiratory, dermal, and eye irritation. Acute symptoms associated with ingestion include stomach pain, cramps, headaches, possibly diarrhea and vomiting. These conditions are typically symptomatic of chronic exposure or acute exposure to high concentrations which are not anticipated at this site.

Overexposure to these substances as indicated above typically occurs through ingestion or inhalation of particulates and/or fumes found within some industrial settings. The majority of the available toxicological information has been derived from such settings. In this investigation, potential exposure to these compounds are greatly reduced if not eliminated based on the media in which the contaminants exist. The mobility of these substances are greatly reduced as they are commingled and bound with soil particulates, sediments, as well as underwater. This aspect greatly reduces the mobility of the metals and thereby has a direct impact on the exposure through inhalation. Ingestion possibilities still exist. Exposure via this route is generally facilitated through contaminated hand or glove to mouth contact or to some media which eventually contacts the mouth. This exposure route can also be controlled and thereby minimize exposure potential. Actions include the use of gloves, good work hygiene practices, and through the employment of a suitable decontamination procedure.

These compounds will not have a distinct look, odor, or other physical characteristic.

6.1.4 Inhalation

From a worst-case scenario, COC concentrations immediately above a captured air phase above contaminated groundwater (such as in the head space of a monitoring well) would be of greatest concern. However, in regarding the results of this data evaluation, it is important to recognize the following:

- the planned work area is outdoors, with ample natural ventilation that will reduce any airborne COCs through dilution and dispersion,

- the groundwater value used in this evaluation was the highest concentration detected during the most recent groundwater monitoring event,

As a result of these factors, it is very unlikely that workers participating in this activity will encounter any airborne concentrations of COCs that would represent an occupational exposure concern. To monitor this route, real-time direct reading monitoring instruments will be used (as described in Section 7.0). This will be performed during intrusive tasks, as these tasks are the most likely to involve encountering/releasing any COCs into the air phase.

In addition, workers will monitor for visible dust, and in the event that visible dust is seen, area wetting techniques will be employed for dust suppression during active/intrusive activities.

6.1.5 Ingestion and Skin Contact

Potential exposure concerns to the COCs may also occur through ingestion, or coming into direct skin contact with contaminated groundwater. The likelihood of worker exposure concerns through these two routes are also considered very unlikely, provided that workers follow good personal hygiene and standard good sample collection/sample handling practices, and wear appropriate PPE as specified in this HASP. Examples onsite practices that are to be observed that will protect workers from exposure via ingestion or skin contact include the following:

- No hand-to-mouth activities on site (eating, drinking, smoking, etc.)
- Washing hands upon leaving the work area and prior to performing any hand to mouth activities
- Wearing surgeon's-style gloves whenever handling potentially-contaminated media, including groundwater and any potential free product, sampling equipment, and sample containers.

6.2 PHYSICAL HAZARDS

The following is a list of physical hazards that may be encountered at the site or may be present during the performance of site activities.

- Slips, trips, and falls
- Cuts (or other injuries associated with hand tool use)
- Lifting (strain/muscle pulls)
- Ambient temperature extremes (heat stress)
- Pinches and compressions

- Vehicular and foot traffic
- Noise in excess of 85 dBA
- Flying projectiles
- Contact with underground or overhead utilities/electrical safety
- Heavy equipment hazards (rotating equipment, hydraulic lines, etc.)
- Compressed gas cylinders

Specific hazards are discussed further below, and are presented relative to each task in the task-specific Safe Work Permits.

6.2.1 Slips, Trips, and Falls

During various site activities there is a potential for slip, trip, and fall hazards associated with wet, steep, or unstable work surfaces. To minimize hazards of this nature, personnel required to work in and along areas prone to these types of hazards will be required to exercise caution, and use appropriate precautions (restrict access, guardrails, life lines and/or safety harnesses) and other means suitable for the task at hand. Site activities will be performed using the buddy system.

6.2.2 Strain/Muscle Pulls from Heavy Lifting

During execution of planned activities there is some potential for strains, sprains, and/or muscle pulls due to the physical demands and nature of this site work. To avoid injury during lifting tasks personnel are to lift with the force of the load carried by their legs and not their backs. When lifting or handling heavy material or equipment use an appropriate number of personnel. Keep the work area free from ground clutter to avoid unnecessary twisting or sudden movements while handling loads.

6.2.3 Heat/Cold Stress

Because of the length of planned project activities, the likely seasonal weather conditions that will exist during the planned schedule, and the physical exertion that can be anticipated with some of the planned tasks, it will be necessary for the field team to be aware of the signs and symptoms and the measures appropriate to prevent cold stress. This is addressed in detail in Section 4.0 of the Tetra Tech Health and Safety Guidance Manual, which the SSO is responsible for reviewing and implementing as appropriate on this project.

6.2.4 Pinch/Compression Points

Handling of tools, machinery, and other equipment on site may expose personnel to pinch/compression point hazards during normal work activities. Where applicable, equipment will have intact and functional

guarding to prevent personnel contact with hazards. Personnel will exercise caution when working around pinch/compression points, using additional tools or devices (e.g., pinch bars) to assist in completing activities.

6.2.5 Natural Hazards

Natural hazards such as poisonous plants, bites from poisonous or disease carrying animals or insects (e.g., snakes, ticks, mosquitoes) are often prevalent at sites that are being investigated as part of hazardous waste site operations. To minimize the potential for site personnel to encounter these hazards, nesting areas in and about work areas will be avoided to the greatest extent possible. Work areas will be inspected to look for any evidence that dangerous animals may be present. Based on the planned location for the work covered by this HASP, encountering wild animals is not a likely probability.

During warm months (spring through early fall), tick-borne Lyme Disease may pose a potential health hazard. The longer a disease carrying tick remains attached to the body, the greater the potential for contracting the disease. Wearing long sleeved shirts and long pants (tucked into boots and taped) will prevent initial tick attachment, while performing frequent body checks will help prevent long term attachment. Site first aid kits should be equipped with medical forceps and rubbing alcohol to assist in tick removal. For information regarding tick removal procedures and symptoms of exposure, consult Section 4.0 of the Health and Safety Guidance Manual.

Contact with poisonous plants and bites or stings from poisonous insects are other potential natural hazards. Long sleeved shirts and long pants (tucked into boots), and avoiding potential nesting areas, will minimize the potential for exposure. Additionally, insect repellents may be used by site personnel. Personnel who are allergic to stinging insects (such as bees, wasps and hornets) must be particularly careful since severe illness and death may result from allergic reactions. As with any medical condition or allergy, information regarding the condition must be listed on the Medical Data Sheet (see Attachment III of this HASP), and the FOL or SSO notified.

6.2.6 Vehicular and Equipment Traffic

If working in or near streets or roadways, hazards associated with vehicular and equipment traffic are likely to exist during various site activities and whenever site personnel performed work on or near roadways. Site personnel will be instructed to maintain awareness of traffic and moving equipment when performing site activities. When working near roadways, site personnel will wear high visibility vests.

6.2.7 Inclement Weather

Project tasks under this Scope of Work will be performed outdoors. As a result, inclement weather may be encountered. In the event that adverse weather (electrical storms, tornadoes, etc.) conditions arise, the FOL and/or the SSO will be responsible for temporarily suspending or terminating activities until hazardous conditions no longer exist.

6.2.8 Contact with Underground or Overhead Utilities/Electrical Safety

Contact with energized sources can result in severe injury and even death. There are two areas of concern with this potential hazard: contact with energized processing equipment and contact with energized utilities including underground utilities (i.e., electrical transmission lines, gas lines, water lines, etc.) and overhead utilities (i.e., power lines, etc.).

- Use and application of the Tetra Tech Standard Operating Procedure (SOP) for Utility Locating and Excavation Clearance found in the Tetra Tech Health and Safety Guidance Manual will be employed. This procedure provides step-by-step instructions for clearance of underground utilities, as well as avoidance techniques, and required documentation.
- Establishment of a suitable clearance distance (20-feet) from overhead utilities will be the primary method to control hazards conveyed through contact with these power sources.
- Identify underground utilities and buried structures before commencing any DPT operations. Follow the Tetra Tech Utility Locating and Excavation Clearance Standard Operating Procedure.

In addition, the electrical safety procedures stipulated in Section 3.9 of the LM Handbook and the overhead power line safety procedures in Section 3.14 of the LM Handbook will also be followed.

No hazardous energy work is being conducted as part of this field effort. However, should activities associated with lockout/tagout be required, the requirements stipulated in Section 3.5 of the LM Handbook (Attachment I) will also be adhered to.

6.2.9 Heavy Equipment/Excavation Hazards

Ensure that workers are thoroughly trained and competent to perform their assigned task with the equipment used in investigation. Ensure that back-up alarms are functional on equipment. Heavy equipment will be subjected to an equipment inspection, upon arrival on-site and prior to leaving. This inspection will be recorded on the Equipment Inspection Checklist provided in Attachment V of this HASP. The equipment operators and on-site Supervisors responsible for the equipment are to ensure that the

Equipment Inspection Checklist has been reviewed and completed, and that all moving parts are guarded if such parts are exposed. Check/test all emergency stop controls. Use escort vehicles with flashing lights to ward and control local traffic when moving large equipment to support area. Only trained and authorized workers may operate heavy equipment, industrial vehicles and/or cranes. All manufacturer's specifications and limitations will be adhered to. Utility clearances should be in place prior to the beginning of excavation (in accordance with the Tetra Tech Utility Locating SOP in the Health and Safety Guidance Manual Section 7.0).

An Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP. Detailed Tetra Tech Excavation Safety Procedures, the Excavation Competent Person Checklist, the Tetra Tech Confined Space Entry Program and Procedures, and the Heavy Equipment Inspection Checklist are included in Attachments VI, VII, VIII, and IX, and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment X and must be followed during all excavation work.

In addition, the heavy equipment, industrial vehicle, and crane operation safety procedures and excavation procedures stipulated in Section 3.13 and 3.8 of the LM Handbook and will be followed.

6.2.10 Compressed Gas Cylinders

Work utilizing compressed gas cylinders is not anticipated as part of this field effort. However, if work utilizing compressed gas cylinders is required, this HASP will be updated/amended as necessary and the procedures in Section 3.17 of the LM Handbook (Attachment I) will be followed.

6.2.11 Noise

Hearing protection must be worn in all areas posted to indicate high noise level or where employees are exposed to noise levels in excess of the OSHA action level (85 dBA over an 8-hour time-weighted average or a dose of fifty percent).

7.0 AIR MONITORING

As a precaution direct reading instrument will be used for onsite activities to screen source areas (i.e., monitoring wells) and worker breathing zones for the presence of volatile site contaminants. At least twice each day (e.g., at the beginning and end of each work day), the SSO will establish background levels by operating the instrument at locations that are at the perimeter of the site property, and that are upwind of planned or ongoing site activities, unlikely to be affected by any intrusive site activities performed as part of this investigation. These daily-established background levels will be the baseline for comparing all other direct reading instrument readings noted during the performance of intrusive activities. Any readings noted above 10 PPM for five minutes four times a day will be regarded as "elevated" and interpreted as possible indications of airborne releases from site activities, warranting specific action specified in this section.

If instrument readings indicate airborne levels (lasting five minutes or longer) in BZ areas that are higher than the daily established background levels, this will require site activities to be suspended and workers to retreat upwind to the pre-determined emergency congregation point. Work may not resume until and unless readings return to background levels. The use of personal protective equipment and the observance of the other control requirements presented in this HASP have been selected to minimize potential for personnel exposures to hazardous concentrations of the site contaminants of concern presented in Section 6.0.

7.1 INSTRUMENTS AND USE

Instruments will be used primarily as described above to monitor source points and worker breathing zone areas, observing instrument action levels. Action levels are discussed in Section 7.1.1 as they may apply to a specific task or location.

7.1.1 Photoionization Detector

Based on the properties of the identified contaminants of concern, a Photoionization Detector (PID) equipped with a lamp strength of at least 10.6 eV lamp will be appropriate to screen source areas (sampling locations, monitoring wells, bore holes, etc.) during intrusive site activities at the two planned site work areas. This instrument will also be used to periodically (e.g., at least 3-4 times each day) to monitor the breathing zones of employees during site activities for elevated readings above the daily-established background level. The PID suitably equipped with the appropriate lamp strength has been selected because it is capable of detecting all of the identified contaminants of concern at the site.

As previously mentioned, daily background level readings will be taken away from any areas of potential contamination. These readings must be documented in the field operations logbook or other site documentation (e.g., sample log sheet).

Instrument Action Levels: The use of a PID will be acceptable, provided that the following action levels are observed:

- PID Action Level: any reading >10 ppm for more than 5 minutes above background in the breathing zone for 4 exposures of 5 minutes in one workday.
- Generation of dusts should be minimized. If airborne dusts are observed, area wetting methods will be used. If area wetting methods are not feasible, termination of activities may be used to minimize exposure to observed airborne dusts.

7.1.2 Hazard Monitoring Frequency

The frequency that hazard monitoring will be performed as well as the action levels will be determined by the PHSO who will also initiate the use of elevated levels of protection. The SSO may decide to increase these frequencies based on instrument responses and site observations. The frequency at which monitoring is performed will not be reduced without the prior consent of the PHSO or HSM.

7.2 INSTRUMENT MAINTENANCE AND CALIBRATION

Hazard monitoring instruments will be maintained and pre-field calibrated by the equipment provider (i.e., rental agency used). Operational checks and field calibration will be performed on site instruments each day prior to their use. Field calibration will be performed on instruments according to manufacturer's recommendations. These operational checks and calibration efforts will be performed in a manner that complies with the employees health and safety training, the manufacturer's recommendations, and with the applicable manufacturer standard operating procedure (which the SSO must assure are included with the instrument upon its receipt onsite). Field calibration efforts must be documented. Figure 7-1 is provided for documenting these calibration efforts. This information may instead be recorded in a field operations logbook, provided that the information specified in Figure 7-1 is recorded. This required information includes the following:

- Date calibration was performed
- Individual calibrating the instrument
- Instrument name, model, and serial number
- Any relevant instrument settings and resultant readings (before and after) calibration

- Identification of the calibration standard (lot no., source concentration, supplier)
- Any relevant comments or remarks

7.3 DOCUMENTING INSTRUMENT READINGS

The SHSO is responsible for ensuring that air monitoring instruments are used in accordance with the specifications of this HASP and with manufacturer's specifications/recommendations. In addition, the SHSO is also responsible for ensuring that all instrument use is documented. This requirement can be satisfied either by recording instrument readings on pre-printed sampling log sheets or in a field log book.

This includes the requirement for documenting instrument readings that indicate no elevated readings above noted daily background levels (i.e., no-exposure readings). At a minimum, the SHSO must document the following information for each use of an air monitoring device:

- Date, time, and duration of the reading
- Site location where the reading was obtained
- Instrument used (e.g., PID, etc.)
- Personnel present at the area where the reading was noted
- Other conditions that are considered relevant to the SHSO (such as weather conditions, possible instrument interferences, etc.)

DOCUMENTATION OF FIELD CALIBRATION

PROJECT NO.:_____

[illegible]

8.0 TRAINING/MEDICAL SURVEILLANCE REQUIREMENTS

8.1 INTRODUCTORY/REFRESHER/SUPERVISORY TRAINING

This section is included to specify health and safety training and medical surveillance requirements for Tetra Tech personnel participating in on site activities. Tetra Tech personnel must complete 40 hours of introductory hazardous waste site training prior to performing work at the LMC MRC. Tetra Tech personnel who have had introductory training more than 12 months prior to site work must have completed 8 hours of refresher training within the past 12 months before being cleared for site work. In addition, 8-hour supervisory training in accordance with 29 CFR 1910.120(e)(4) will be required for site supervisory personnel. Tetra Tech and subcontractor personnel working on site who are potentially exposed to hazardous substances shall receive initial and annual refresher training in accordance with 29 CFR 1910.120(e) – *Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard. Lockheed Martin shall be provided with electronic copies of the training certificates.

Documentation of Tetra Tech introductory, supervisory, and refresher training as well as site-specific training will be maintained at the site. Copies of certificates or other official documentation will be used to fulfill this requirement.

The requirements described in Section 3.20.3 of the LM Handbook (Attachment I) addressing training will be followed.

8.2 SITE-SPECIFIC TRAINING

Tetra Tech SSO will provide site-specific training to Tetra Tech employees who will perform work on this project. Figure 8-1 will be used to document the provision and content of the project-specific and associated training. Site personnel will be required to sign this form prior to commencement of site activities. This training documentation will be employed to identify personnel who through record review and attendance of the site-specific training are cleared for participation in site activities. This document shall be maintained at the site to identify and maintain an active list of trained and cleared site personnel.

The Tetra Tech SSO will also conduct a pre-activities training session prior to initiating site work. This will consist of a brief meeting at the beginning of each day to discuss operations planned for that day, and a review of the appropriate Safe Work Permits with the planned task participants. A short meeting may also be held at the end of the day to discuss the operations completed and any problems encountered.

8.3 MEDICAL SURVEILLANCE

Tetra Tech personnel participating in project field activities will have had a physical examination meeting the requirements of Tetra Tech's medical surveillance program. Documentation for medical clearances will be maintained in the Tetra Tech Pittsburgh office and made available, as necessary, and will be documented using Figure 8-1 for every employee participating in onsite work activities at this site. Tetra Tech shall provide evidence of employee enrollment in a medical surveillance program. Lockheed Martin does not provide medical surveillance examinations to contractor employees.

The medical surveillance requirements described in Section 3.20.4 of the LM Handbook (Attachment I) will be followed.

Each field team member, including visitors, entering the exclusion zone(s) shall be required to complete and submit a copy of the Medical Data Sheet (see Attachment III of this HASP). This shall be provided to the SSO, prior to participating in site activities. The purpose of this document is to provide site personnel and emergency responders with additional information that may be necessary in order to administer medical attention.

FIGURE 8-1

SITE-SPECIFIC TRAINING DOCUMENTATION

My signature below indicates that I am aware of the potential hazardous nature of performing field activities at LCM MSA and that I have received site-specific training which included the elements presented below:

- Names of designated personnel and alternates responsible for site safety and health
- Safety, health, and other hazards present on site
- Use of personal protective equipment
- Safe use of engineering controls and equipment
- Medical surveillance requirements
- Signs and symptoms of overexposure
- Emergency response procedures (evacuation and assembly points)
- Incipient response procedures
- Review of the contents of relevant Material Safety Data Sheets
- Review of the use of Safe Work Permits
- Stop Work Procedures

I have been given the opportunity to ask questions and all of my questions have been answered to my satisfaction. The dates of my training and medical surveillance requirements indicated below are accurate.

[illegible]

9.0 SITE CONTROL

This section outlines the means by which Tetra Tech will delineate work zones and use these work zones in conjunction with decontamination procedures to prevent the spread of contaminants into previously unaffected areas of the site. It is anticipated that a three-zone approach will be used during work at this site. This approach will be comprised of an exclusion zone, a contamination reduction zone, and a support zone. It is also anticipated that this approach will control access to site work areas, restricting access by the general public, minimizing the potential for the spread of contaminants, and protecting individuals who are not cleared to enter work areas.

9.1 EXCLUSION ZONE

The exclusion zone will be considered the areas of the site of known or suspected contamination. It is anticipated that the areas around active/intrusive activities will have the potential for contaminants brought to the surface. These areas will be marked and personnel will maintain safe distances. Once active/intrusive activities have been completed and any surface contamination has been removed, the potential for exposure is again diminished and the area can then be reclassified as part of the contamination reduction zone. The exclusion zones for this project are those areas of the site where active work (DPT work areas, drilling, installation, and sample collection, etc.) is being performed plus a designated area of at least 25 feet surrounding the work area. Exclusion zones will be delineated as deemed appropriate by the FOL, through means such as erecting visibility fencing, barrier tape, cones, and/or postings to inform and direct personnel.

9.1.1 Exclusion Zone Clearance

An Exclusion Zone (EZ) will be established at each well installation/sampling location. The purpose of establishing and maintaining these localized exclusion zones is to define areas where more rigorous safety and health protection measures will be required and to designate areas restricted to non-essential and unauthorized personnel. The size and dimensions of these EZs will vary based on the nature of the planned activities, and may be subject to change at the SSO's discretion based on factors such as visual observations, nearby concurrent operations, and other factors. However, the following dimensions represent basic considerations for establishing EZs:

- DPT and associated concurrent sampling activities. The EZ for this activity will be set at the height of the mast, plus five feet surrounding the point of operation, with a minimum of 25-feet. This distance will also apply when surface and subsurface soil sampling from behind these type rigs.

- Monitoring well development, purging, piezometer construction and use, and collecting groundwater samples and water level readings. The EZ for these activities will be set to encompass an area of at least 10-feet surrounding the well head.
- Decontamination operations. The EZ for this activity will be set at 25 feet surrounding the gross contamination wash and rinse as well as 25-feet surrounding the heavy equipment decontamination area. Sample equipment decontamination boundaries will be set at 10-feet surrounding hand wash and rinse areas.
- Investigative Derived Waste (IDW) area will be constructed and barricaded. Only authorized personnel will be allowed access.

EZs will be marked using barrier tape, traffic cones and/or drive pole, or other readily-visible devices. Signs may also be posted at the SSO's discretion to inform and direct site personnel and site visitors. EZs shall remain marked until the SSO has evaluated the restoration effort and has authorized changing the zone status.

9.2 CONTAMINATION REDUCTION ZONE

Contamination Reduction Zones (CRZs) will be established to minimize the potential for the spread of contaminated media from being spread into previously-unaffected areas. The primary function of a CRZ is to provide an adequate area for decontamination activities. For personal and small item (e.g., sampling equipment) decontamination activities, a CRZ will be established at the perimeter of each EZ. For decontamination activities that will require specialized equipment, larger areas, and more significant containment, a heavy equipment decontamination pad CRZ will be established in one or more areas to support the two work areas...

In order to move from on EZ to another, the following activities will be performed in the localized CRZs:

- As samplers move from location to location, dedicated sampling devices and PPE will be washed to remove visible gross contamination, and then these items will be bagged and removed. Personnel will use hygienic wipes (such as "baby wipes") as necessary for interim personnel decontamination until they can access a facility equipped with hands washing and rinsing capabilities. At the first available opportunity personnel will wash their face and hands. This is critical prior to breaks and lunch when contamination may be transferred to the mouth through hand to mouth contact.
- Disposable PPE, sampling equipment, and other items are to be sequentially removed/deposited and double-bagged. Such waste is to be disposed of in accordance with the direction of the client.

Reusable items that are grossly contaminated (such as muddy over-boots, hardhats, etc.) will be required to be removed, bagged, and taken to the established decontamination pad for washing and rinsing prior to being used at another EZ. .

- Potentially contaminated tooling will be wrapped, as necessary, for transport to the decontamination area for cleaning.

9.3 SUPPORT ZONE

The support zone for this project will include a staging area where site vehicles will be parked, equipment will be unloaded, and where food and drink containers will be maintained. The support zones will be established at areas of the site where away from potential exposure to site contaminants during normal working conditions or foreseeable emergencies.

9.4 SAFE WORK PERMITS

Exclusion Zone work conducted in support of this project will be performed using Safe Work Permits (SWPs) to guide and direct field crews on a task by task basis. An example of the SWP to be used is provided in Figure 9-1. Partially completed SWPs for the work to be performed are attached (Attachment IV) to this HASP. These permits were completed to the extent possible as part of the development of this HASP. It is the SSO's responsibility to finalize and complete all blank portions of the SWPs based on current, existing conditions the day the task is to be performed, and then review that completed permit with all task participants as part of a pre-task tail gate briefing session. This will ensure that site-specific considerations and changing conditions are appropriately incorporated into the SWP, provide the SSO with a structured format for conducting the tail gate sessions, as well will also give personnel an opportunity to ask questions and make suggestions. All SWPs require the signature of the FOL or SSO.

9.5 SITE SECURITY

As this activity will take place at an active facility, the first line of security will be provided by the facility entrance/gate restricting the general public. The second line of security will take place at the work site referring interested parties to the FOL and LMC Contact.

Security at the work areas will be accomplished using field personnel. This is a multiple person operation, involving multiple operational zones. Tetra Tech NUS personnel will retain complete control over active operational zones.

The site contact will serve as the focal point for facility personnel and interested parties and will serve as the primary enforcement contact.

9.6 SITE VISITORS

Site visitors for the purpose of this document are identified as representing the following groups of individuals:

- Personnel invited to observe or participate in operations by Tetra Tech
- Regulatory personnel (i.e. EPA, MDEP, OSHA)
- Property Owners
- Authorized Personnel
- Other authorized visitors

Non Tetra Tech personnel working on this project are required to gain initial access to the facility by coordinating with the Tetra Tech FOL or designee and following established facility access procedures.

Once access to the base is obtained, personnel who require site access into areas of ongoing operations will be required to obtain permission from the PM. In addition, site visitors wishing to observe operations in progress will be escorted by a Tetra Tech representative and shall be required to meet the minimum requirements discussed below:

- Site visitors will be directed to the FOL/SSO, who will sign them into the field logbook. Information to be recorded in the logbook will include the individual's name (proper identification required), the entity which they represent, and the purpose of the visit.
- Site visitors must be escorted and restricted from approaching any work areas where they could be exposed to hazards from Tetra Tech operations. If a visitor has authorization from the client and from the Tetra Tech Project Manager to approach our work areas, the FOL must assure that the visitor first provides documentation indicating that he/she/they have successfully completed the necessary OSHA introductory training, receive site-specific training from the SSO, and that they have been physically cleared to work on hazardous waste sites. Site visitors wishing to enter the exclusion zone will be required to produce the necessary information supporting clearance to the site. This shall include information attesting to applicable training and medical surveillance as stipulated in Section 8.0 of this document. In addition, to enter the site operational zones during planned activities, visitors will be required to first go through site-specific training covering the topics stipulated in Section 8.2 of

this HASP. All jobsite visitors must have a safety orientation prior to commencing work or touring the site. A visitor log will be kept to document the orientation.

- Once the site visitors have completed the above items, they will be permitted to enter the operational zone. Visitors are required to observe the protective equipment and site restrictions in effect at the site at the time of their visit. Visitors entering the exclusion zones during ongoing operations will be accompanied by a Tetra Tech representative. Visitors not meeting the requirements, as stipulated in this plan, for site clearance will not be permitted to enter the site operational zones during planned activities. Any incidence of unauthorized site visitation will cause the termination of on site activities until the unauthorized visitor is removed from the premises. Removal of unauthorized visitors will be accomplished with support from local law enforcement personnel.

9.7 SITE MAP

Once the areas of contamination, access routes, topography, and dispersion routes are determined, a site map will be generated and adjusted as site conditions change. These maps will be posted to illustrate up-to-date collection of contaminants and adjustment of zones and access points.

9.8 BUDDY SYSTEM

Personnel engaged in on site activities will practice the "buddy system" to ensure the safety of personnel involved in this operation.

9.9 COMMUNICATION

As personnel will be working in proximity to one another during field activities, a supported means of communication between field crew members will not be necessary.

External communication will be accomplished by using the cell phones/telephones at predetermined and approved locations. External communication will primarily be used for the purpose of resource and emergency resource communications. Prior to the commencement of activities at the LCM MRC, the FOL will determine and arrange for telephone communications.

9.10 SELF-AUDITS

The procedures outlined in Section 7 of the LM Handbook (Attachment I) addressing self-audits will be adhered to.

Tetra Tech and/or subcontractor personnel will perform periodic work area/project field inspections to monitor compliance with project environmental, safety and health requirements. The name of Tetra Tech's jobsite health and safety (H&S) representative will be provided to Lockheed Martin prior to starting work at the jobsite.

For jobs that are ongoing, an annual H&S audit shall be conducted and for jobs with a duration of less than one year at least one audit shall occur. A competent H&S representative designated by the Tetra Tech shall perform the audit. Unsafe acts and/or non-compliance conditions noted during inspections shall be corrected immediately.

The documentation related to the audits and inspections shall be submitted electronically to the Lockheed Martin Project Lead.

FIGURE 9-1 SAFE WORK PERMIT

Permit No. _____ Date: _____ Time: From _____ to _____

I. Work limited to the following (description, area, equipment used): _____

II. Primary Hazards: Potential hazards associated with this task: _____

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. Protective equipment required

Respiratory equipment required

Level D ☐ Level B ☐
 Level C ☐ Level A ☐

Yes ☐ Specify on the reverse
 No ☐

Modifications/Exceptions: _____

VI. Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Primary Route(s) of Exposure/Hazard: _____

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat.....	<input type="checkbox"/> Yes <input type="checkbox"/> No	Hearing Protection (Plugs/Muffs)	<input type="checkbox"/> Yes <input type="checkbox"/> No
Safety Glasses	<input type="checkbox"/> Yes <input type="checkbox"/> No	Safety belt/harness	<input type="checkbox"/> Yes <input type="checkbox"/> No
Chemical/splash goggles	<input type="checkbox"/> Yes <input type="checkbox"/> No	Radio/Cellular Phone	<input type="checkbox"/> Yes <input type="checkbox"/> No
Splash Shield.....	<input type="checkbox"/> Yes <input type="checkbox"/> No	Barricades.....	<input type="checkbox"/> Yes <input type="checkbox"/> No
Splash suits/coveralls	<input type="checkbox"/> Yes <input type="checkbox"/> No	Gloves (Type –).....	<input type="checkbox"/> Yes <input type="checkbox"/> No
Impermeable apron.....	<input type="checkbox"/> Yes <input type="checkbox"/> No	Work/rest regimen.....	<input type="checkbox"/> Yes <input type="checkbox"/> No
Steel toe Work shoes or boots...	<input type="checkbox"/> Yes <input type="checkbox"/> No	Chemical Resistant Boot Covers.....	<input type="checkbox"/> Yes <input type="checkbox"/> No
High Visibility vest.....	<input type="checkbox"/> Yes <input type="checkbox"/> No	Tape up/use insect repellent	<input type="checkbox"/> Yes <input type="checkbox"/> No
First Aid Kit	<input type="checkbox"/> Yes <input type="checkbox"/> No	Fire Extinguisher	<input type="checkbox"/> Yes <input type="checkbox"/> No
Safety Shower/Eyewash.....	<input type="checkbox"/> Yes <input type="checkbox"/> No	Other	<input type="checkbox"/> Yes <input type="checkbox"/> No

Modifications/Exceptions: _____

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated (Splash and containment barriers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc).....	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IX. Additional Permits required (Hot work, confined space entry, excavation etc.)..... ☐ Yes ☐ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: _____

Permit Issued by: _____ Permit Accepted by: _____

10.0 SPILL CONTAINMENT PROGRAM AND WASTE MANAGEMENT PLAN

10.1 SCOPE AND APPLICATION

It is not anticipated that bulk hazardous materials (over 55-gallons) will be generated or handled at any given time as part of this scope of work. It is also not anticipated that such spillage would constitute a danger to human health or the environment.

This Spill Prevention and Containment Program applies to the potential release from one or more containers on the work site involving a single or aggregate accumulation of bulk storage materials (over 55-gallons). As the classification of certain materials such as IDW is unknown, these materials will be treated as hazardous, pending laboratory certification to the contrary.

However, as the job progresses, some potential may exist for accumulating Investigative Derived Wastes (IDW) such as decontamination fluids, soil cuttings, disposable sampling equipment and PPE.

The spill containment and control will be engaged any time there is a release of the above-identified materials from a containment system or vessel. This spill containment program will be engaged in order to minimize associated hazards.

10.2 POTENTIAL SPILL AREAS

Potential spill areas will be periodically monitored in an ongoing attempt to prevent and control further potential contamination of the environment. Currently, limited areas are vulnerable to this hazard including:

- Resource deployment
- Waste transfer
- Central staging

It is anticipated that the IDW generated as a result of this scope of work will be containerized, labeled, and staged to await further analyses. The results of these analyses will determine the method of disposal.

10.3 LEAK AND SPILL DETECTION

To establish an early detection of potential spills or leaks, a periodic walk-around by the personnel staging or disposing of drums area will be conducted during working hours to visually determine that storage vessels are not leaking. If a leak is detected, the contents will be transferred, using a hand pump,

into a new vessel. The leak will be collected and contained using absorbents such as Oil-Dry, vermiculite, or sand, which are stored at the vulnerable areas in a conspicuously marked drum. This used material, too, will be containerized for disposal pending analysis. Inspections will be documented in the project logbook.

In case of a spill or release of hazardous chemicals, Tetra Tech shall immediately notify the Lockheed Martin Project Lead, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1. Tetra Tech shall take all necessary steps to control the spread of the release and to provide site control to prevent unauthorized personnel from entering the affected area.

Section 8.2 of the LM Handbook (Attachment I) pertaining to spill reporting will be addresses.

10.4 PERSONNEL TRAINING AND SPILL PREVENTION

Personnel will be instructed in the procedures for incipient spill prevention, containment, and collection of hazardous materials in the site-specific training. The FOL and the SSO will serve as the Spill Response Coordinators for this operation, should the need arise.

10.5 SPILL PREVENTION AND CONTAINMENT EQUIPMENT

The following represents the types of equipment that should be maintained at the staging areas for the purpose of supporting this Spill Prevention/Containment Program.

- Sand, clean fill, vermiculite, or other non combustible absorbent (Oil-dry)
- Drums (55-gallon U.S. DOT 1A1 or 1A2)
- Shovels, rakes, and brooms
- Container labels

Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplied shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

10.6 SPILL CONTROL PLAN

This section describes the procedures the Tetra Tech field crew members will employ upon the detection of a spill or leak.

- Notify the SSO or FOL immediately upon detection of a leak or spill. Activate emergency alerting procedures for that area to remove non-essential personnel.

- Employ the personal protective equipment stored at the staging area. Take immediate actions to stop the leak or spill by plugging or patching the container or raising the leak to the highest point in the vessel. Spread the absorbent material in the area of the spill, covering it completely.
- Transfer the material to a new vessel; collect and containerize the absorbent material. Label the new container appropriately. Await analyses for treatment and disposal options.
- Re-containerize spills, including 2-inch of top cover impacted by the spill. Await test results for treatment or disposal options.

It is not anticipated that a spill will occur that the field crew cannot handle. Should this occur, notification of the appropriate Emergency Response agencies will be carried out by the FOL or SSO in accordance with the procedures discussed in Section 2.0 of this HASP.

As mentioned above, in the event of a spill or release of hazardous chemicals, Tetra Tech will immediately notify the LMC personnel in the order presented in Table 2-1, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1.

10.7 WASTE MANAGEMENT PLAN

Tetra Tech personnel will adhere to the decontamination and waste management procedures laid out the Tetra Tech HSGM and the Tetra Tech Decontamination of Field Equipment and Waste Handling Standard Operating Procedure (Attachment XI).

In addition, all requirements described in Sections 4.1 and 4.2 of the LM Handbook (Attachment I) will be addressed.

11.0 CONFINED-SPACE ENTRY

It is not anticipated, under the proposed scope of work, that confined space and permit-required confined space activities will be conducted. **Therefore, personnel under the provisions of this HASP are not allowed, under any circumstances, to enter confined spaces.** A confined space is defined as an area which has one or more of the following characteristics:

- Is large enough and so configured that an employee can bodily enter and perform assigned work.
- Has limited or restricted means for entry or exit (for example, tanks, manholes, sewers, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- Is not designed for continuous employee occupancy.

Additionally, a Permit-Required Confined Space must also have one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly caving walls or by a floor that slopes downward and tapers to a smaller cross-section.
- Contains any other recognized, serious, safety or health hazard.

For further information on confined space, consult the Health and Safety Guidance Manual or call the PHSO. If confined space operations are to be performed as part of the scope of work, detailed procedures and training requirements will have to be addressed and this HASP will be updated/amended as necessary to address the confined space entry requirements detailed in Section 3.3 of the LM Handbook (Attachment I).

12.0 HOT WORK

No hot work activities are being conducted as part of this field effort. Should hot work be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.4 of the LM Handbook (Attachment I).

13.0 USE OF LOCKHEED MARTIN MATERIALS AND EQUIPMENT

No Lockheed Martin materials, tools, equipment, PPE shall be used until authorized by Lockheed Martin.

No Tetra Tech personnel will start, stop, relocate, or adjust any Lockheed Martin process or production equipment without approval of the Lockheed Martin Project Lead. Details of these requirements are described in Section 3.6 of the LM Handbook.

14.0 ELEVATED LOCATIONS / LADDERS / SCAFFOLDS

No elevated location work, ladder work, or scaffolding activities are being conducted as part of this field effort. Should any of these activities be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Sections 3.10, 3.11, and 3.12 of the LM Handbook (Attachment I).

15.0 DANGEROUS OPERATIONS

Tetra Tech and subcontractor personnel will isolate their work areas from Lockheed Martin operations, employees, and the public. Barricades, signs, and signals will be employed as necessary and will be visible at all times where hazards exist.

Tetra Tech and subcontractors will effectively barricade excavations, floor openings, etc. as required by OSHA regulations.

Prior to beginning work, Tetra Tech and subcontractors must inform the Lockheed Martin Project Lead of any potentially dangerous operations.

All requirements addressing dangerous operations are detailed in Section 3.7 of the LM Handbook and will be adhered to.

16.0 EXCAVATIONS, TRENCHES, AND EARTHWORK

This field effort includes the excavation of test pits, therefore the following excavation procedures will apply to the excavation work.

16.1 EXCAVATION SAFE WORK PRACTICES

- Utility clearances should be in place prior to the beginning of excavation (in accordance with the Tetra Tech Utility Locating SOP in the Health and Safety Guidance Manual Section 7.0).
- Excavation boundaries should be demarcated with appropriate warning signs (e.g., construction activities in progress).
- Traffic patterns for equipment and the loading of trucks should be established. This pattern should form a loop to minimize backing, an activity which causes many accidents.
- Traffic patterns for foot and small vehicular traffic should keep workers away from heavy equipment.
- Traffic patterns for heavy equipment should be constructed to maintain traffic flow a minimum of 10 feet from unsupported walls or excavation boundaries.
- Excavation along thoroughfares will require the use of warning signs, barricades and flag-persons for alteration of traffic patterns, as necessary.
- Ground personnel should be provided with reflective vests to increase visibility and air horns to signal loud trucks and heavy equipment.
- Ground activities with heavy equipment should be supported with a ground spotter. The operators should be instructed that they are to follow the instructions provided by the ground spotter unless another party is otherwise authorized.
- Surface encumbrances within the intended work area of the excavation will be removed or supported, as necessary, in accordance with OSHA 1926.651(a).
- Prior to being put into service at the site, the excavator will be inspected by the SSO, and this inspection will be documented using the applicable forms in Attachment V.

- Heavy equipment will be positioned and operated so that it never approaches closer than 4 feet from the edge of an open excavation (other than the boom and bucket portion of the excavator).
- A decontamination station should be established at the loading and off-loading areas to flush mud and dirt from the wheels and tires as well as any areas of the vehicle impacted during the loading operation.

16.2 EMPLOYER DESIGNATED “COMPETENT PERSON”

The Employer Designated “Competent Person” is responsible for all aspects of excavation safety. This includes:

16.2.1 Pre-Excavation Activities

- Utility Clearance identification and marking
- Establishment of site control measures (temporary utilities, temporary traffic patterns, barricades, signs, etc.)
- Removal and/or control of Surface and Subsurface Encumbrances
- Traffic (Foot/Vehicular) Impact and routing
- Surface drainage patterns and impact

16.2.2 During Excavation Activities

- Utility sweeps
- Review and evaluation of entry/egress systems
- Installing support systems for surface and subsurface encumbrances as necessary (i.e. supporting building foundations, sidewalks, utility runs, etc.)
- Soil classification – Visual and Manual Analysis
- Hazardous atmosphere evaluation (initial and periodic monitoring)
- Recommendation/Installation/Evaluation of protective system (in and out of the excavation)

16.2.3 Post Excavation Activities

- Evaluation of the protective systems installed (sloping, benching, shielding, etc.)
- Soil conditions (Moisture content, fissures developing, horizontal cracks, etc.)
- Loading the excavation walls (Spoils piles, resource/fill materials stock piling, traffic, etc.)
- Atmospheric monitoring
- Backfill

16.2.4 Competent Persons Qualifications

- The employer designates Competent Person(s) based on knowledge and training.
- Capable of identifying existing or predictable hazards associated with excavated cuts or cavities in the earth.
- Has the authority to take prompt action to abate these hazards.
- Working knowledge of Soil Analysis/Soil Classification.
- Knowledgeable in the area of Protective Systems.
- Working knowledge of the requirements of 29 CFR 1926 Subpart P.

This position will typically be filled by Site Safety Officer (SSO), Field Operations Leader (FOL), or a Registered Professional Engineer (PE). The Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP.

Detailed Tetra Tech Excavation Safety Procedures, the Excavation Competent Person Checklist, the Tetra Tech Confined Space Entry Program and Procedures, and the Heavy Equipment Inspection Checklist are included in Attachments VI, VII, VIII and IX, and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment X and must be followed during all excavation work.

16.3 LM EXCAVATION REQUIREMENTS

In addition, the requirements stipulated in Section 3.8 of the LM Handbook (Attachment I) will be reviewed and adhered to during the excavation work and a trained, competent person will be designated to oversee the activities. These requirements include:

- Review the Lockheed Martin intrusive fieldwork requirements in Appendix A of the LM Handbook.
- If workers are to enter excavations, a competent person must be designated and trained in soil classification and the recognition of trenching and excavation hazards.
- Excavations and trenches shall be inspected by a competent person daily and after every rainstorm, earthquake, or other hazard-increasing occurrence.
- Inspect the face, banks, and top daily when workers are exposed to falling or rolling materials.

- Shore, bench, slope, or use equivalent methods to protect workers in excavations four feet deep or more.
- Locate soil at least two feet from the edge of the excavation, or one foot from the edge when the excavation is less than five feet deep.
- Ladders or steps shall be provided and secured in all trenches four feet or more in depth. Ladders shall be located to require no more than twenty-five feet of lateral travel before having access or egress and shall extend three feet above the top of the trench bank.
- Install crossings with standard guardrails and toeboards when the excavation is more than 7½ feet deep.
- All open trenches and other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public.
- Do not excavate beneath the level of adjacent foundations, retaining walls, or other structures until a qualified person has determined that the work will not be hazardous. Support undermined sidewalks.

17.0 ASBESTOS

No asbestos abatement work is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.19 of the LM Handbook (Attachment I).

It is not anticipated during this field effort, but should asbestos containing material (ACM) or presumed asbestos containing material (PACM) be disrupted, Tetra Tech and/or subcontractor personnel shall immediately report to the Lockheed Martin Project Lead and to other employers of employees working at the job site any discovery, disturbance, and/or spill of ACM and/or PACM. All operations will cease in the immediate area of the suspect ACM and/or PACM and demarcate the area. The approval of the Lockheed Martin Project Lead is required before resuming operations.

Tetra Tech and/or subcontractor personnel shall not disturb any pipe insulation, boiler insulation, or any other material reasonably suspected of containing asbestos until the Lockheed Martin is notified and approval is obtained.

Abatement of asbestos can be performed only by persons properly trained and licensed to perform such activities.

All requirements addressed in Section 3.18 of the LM Handbook pertaining to incidental asbestos exposure will be followed.

18.0 NANOTECHNOLOGY

No nanotechnology work is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 3.21 of the LM Handbook (Attachment I).

19.0 WORK INVOLVING AIR EMISSIONS

No work involving air emissions is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 4.3 of the LM Handbook (Attachment I).

20.0 WORK INVOLVING WATER DISCHARGES

No work involving water discharges is being conducted as part of this field effort. Should it be required, this HASP will be amended/updated as necessary to include the requirements stipulated in Section 4.4 of the LM Handbook (Attachment I).

21.0 MATERIALS AND DOCUMENTATION

The Tetra Tech Field Operations Leader (FOL) shall ensure the following materials/documents are taken to the project site and used when required.

- A complete copy of this HASP
- Health and Safety Guidance Manual
- Incident Reports
- Medical Data Sheets
- Material Safety Data Sheets for chemicals brought on site, including decontamination solutions, fuels, sample preservatives, calibration gases, etc.
- A full-size OSHA Job Safety and Health Poster (posted in the site trailer)
- Training/Medical Surveillance Documentation Form (Blank)
- First-Aid Supply Usage Form
- Emergency Reference Form (Section 2.0, extra copy for posting)
- Directions to the Hospital

21.1 MATERIALS TO BE POSTED AT THE SITE

The following documentation is to be posted or maintained at the site for quick reference purposes. In situations where posting these documents is not feasible (such as no office trailer), these documents should be separated and immediately accessible.

- **Chemical Inventory Listing (posted)** - This list represents all chemicals brought on-site, including decontamination solutions, sample preservations, fuel, etc. This list should be posted in a central area.
- **MSDSs (maintained)** - The MSDSs should also be in a central area accessible to all site personnel. These documents should match all the listings on the chemical inventory list for all substances employed on-site. It is acceptable to have these documents within a central folder and the chemical inventory as the table of contents.
- **The OSHA Job Safety & Health Protection Poster (posted – Attachment XII)** - This poster should be conspicuously posted in places where notices to employees are normally posted, as directed by 29 CFR 1903.2 (a)(1). Each FOL shall ensure that this poster is not defaced, altered, or covered by other material. The law also states that reproductions or facsimiles of the poster shall be at least 8 1/2 by 14 inches with 10 point type.

- **Site Clearance (maintained)** - This list is found within the training section of the HASP (Figure 8-1). This list identifies all site personnel, dates of training (including site-specific training), and medical surveillance. The list indicates not only clearance, but also status. If personnel do not meet these requirements, they do not enter the site while site personnel are engaged in activities.
- **Emergency Phone Numbers and Directions to the Hospital(s) (posted)** - This list of numbers and directions will be maintained at all phone communications points and in each site vehicle.
- **Medical Data Sheets/Cards (maintained)** - Medical Data Sheets will be filled out by on-site personnel and filed in a central location. The Medical Data Sheet will accompany any injury or illness requiring medical attention to the medical facility. A copy of this sheet or a wallet card will be given to all personnel to be carried on their person.
- **Personnel Monitoring (maintained)** - All results generated through personnel sampling (levels of airborne toxins, noise levels, etc.) will be posted to inform individuals of the results of that effort.
- **Placards and Labels (maintained)** - Where chemical inventories have been separated because of quantities and incompatibilities, these areas will be conspicuously marked using DOT placards and acceptable [Hazard Communication 29 CFR 1910.1200(f)] labels.

The purpose of maintaining or posting this information, as stated above, is to allow site personnel quick access. Variations concerning location and methods of presentation are acceptable providing the objective is accomplished.

21.2 HAZARD COMMUNICATION – USE OF HAZARDOUS MATERIALS

- All hazardous substance (as defined by OSHA) brought onto Lockheed Martin remediation sites must be accompanied by a MSDS and the containers labeled in accordance with the Red OSHA Hazard Communication Standard, 29 CFR 1910.1200 or applicable state OSHA standard. Tetra Tech and subcontractor personnel will provide MSDSs for chemicals brought on site. The contents of these documents will be reviewed by the SSO with the user(s) of the chemical substances prior to any actual use or application of the substances on site. A chemical inventory of the chemicals used on site will be developed using the Health and Safety Guidance Manual. The MSDSs will then be maintained in a central location (i.e., temporary office) and will be available for anyone to review upon request.

The Lockheed Martin Project Lead shall be notified prior to bringing any quantity of hazardous materials onto Lockheed Martin remediation sites. Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplies shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

All other hazard communication requirements are detailed in Section 3.2 and Section 4.1 of the LM Handbook (Attachment I) and will be adhered to.

22.0 ACRONYMS / ABBREVIATIONS

CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CSP	Certified Safety Professional
DRI	Direct Reading Instrument
FID	Flame Ionization Detector
FOL	Field Operations Leader
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
IDW	Investigation Derived Waste
MDEP	Maryland Department of Environmental Protection
N/A	Not Available
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor)
PHSO	Project Health and Safety Officer
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
SSO	Site Safety Officer
TBD	To be determined
TCE	Trichloroethene
Tetra Tech	Tetra Tech NUS, Inc.
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds

ATTACHMENT I
LOCKHEED MARTIN'S
REMEDIATION CONTRACTOR'S ESH
HANDBOOK



REMEDIATION CONTRACTOR'S ESH HANDBOOK

June 10, 2009

Revision 1

Lockheed Martin Corporation
Energy, Environment, Safety & Health

**A COPY OF THE JOB SPECIFIC HASP SHALL BE
AVAILABLE AT THE JOB SITE FOR THE DURATION OF
THE PROJECT**

REVISION STATUS

[illegible]

CONTRACTOR'S ESH HANDBOOK

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CONTRACTOR'S ESH HANDBOOK

GENERAL

Lockheed Martin Corporation management at all levels is committed to conducting operations and activities in a manner that provides and maintains safe and healthful working conditions, protects the environment, and conserves natural resources.

This *Contractor's ESH Handbook* has been prepared to assist each project jobsite employer/contractor in satisfying its' contractual and legal accident prevention responsibilities, in such a manner that a safe, efficient operation is assured. All applicable requirements outlined in this handbook shall be incorporated into the contractor's site specific Safety and Health Plan. The site specific Safety and Health plan shall be submitted to the Lockheed Martin Project Lead at least two weeks prior to starting work on any Lockheed Martin remediation projects.

This material must not be considered to be all inclusive as to the hazards that might be encountered, safe practices that should be performed, or safe conditions that should be maintained during the course of any project. Moreover, this handbook does not replace the contractor's legal obligation to its employees under all relevant environmental, safety and health requirements and laws. All legal standards not specifically referenced in this handbook shall apply when applicable.

1 CONTRACT RESPONSIBILITIES

The Contractor agrees to comply with all rules and procedures contained in this document, known as the *Remediation Contractor's ESH Handbook*, unless Lockheed Martin specifically agrees, in writing, to a modification or exemption. In addition, the Contractor and subcontractors, at any tier, shall:

- 1.1 Lockheed Martin is a drug free-work workplace. This requirement extends to contractors working on Lockheed Martin remediation projects. Additionally, the use of tobacco is not permitted on Lockheed Martin owned property.
- 1.2 Take all prudent and proper environmental, safety and health (ESH) precautions to protect Lockheed Martin employees, all other workers, and the public from ESH hazards associated with contractor activities.
- 1.3 Comply with all applicable Federal, State, municipal, local, and any other applicable occupational safety and health statutes, rules, ordinances, regulations, and requirements issued or imposed by any governmental authority (including, but not limited to *Title 29, Code of Federal Regulations Parts 1903, 1904, 1910 and 1926*).
- 1.4 Comply with all applicable Federal, State, municipal, local, and any other applicable air pollution statutes, rules, ordinances, regulations, and requirements issued or imposed by any governmental authority.

- 1.5 Comply with all Federal, State, municipal, local and Lockheed Martin hazardous materials, hazardous waste, and non-hazardous waste statutes, rules, ordinances, regulations, and requirements (including, but not limited to *Title 40, Code of Federal Regulations*).
- 1.6 Obtain the applicable ESH permits to conduct the work in compliance with local, state, federal ESH regulations and site requirements (including, but not limiting to *Title 29, Code of Federal Regulations, 1910 and 1926*).
- 1.7 Ensure that all employees and subcontractors have received the appropriate level of ESH training in accordance with applicable ESH regulations necessary for the performance of the work requested by Lockheed Martin.
- 1.8 To instruct, prior to commencement of operations, all employees on the jobsite about relevant governmental laws and regulations, specific hazards expected to be encountered and proper safety precautions to be observed. In addition, jobsite employees shall read and certify that they have read and understand the job specific health and safety plan (HASP). The certification forms provided by the contractor within the HASP shall be electronically sent to the Lockheed Martin Project Lead.
- 1.9 Provide all jobsite visitors with a safety orientation prior to commencing work or touring the site. A visitor log shall be kept to document the orientation.
- 1.10 To ensure Contractor's job specific health and safety plan (HASP) encompasses Federal, State, municipal, local and the Lockheed Martin requirements found within this document the HASP should contain a section on crisis management / emergency response. A copy of the job specific HASP shall be maintained at the job site where jobsite employees have access to a copy. All Contractor Project Managers shall be provided a copy of the *Contractor's ESH Handbook* found within the Lockheed Martin Request for Proposal or as an appendix of the Key National Contractor Agreement. Contractors shall flow these requirements down to their subcontractors.
- 1.11 Contractor understands that Lockheed Martin may immediately stop Contractor's work if Contractor violates any applicable Federal, State, municipal, local, or any other rules, regulations, and requirements, *Remediation Contractor's ESH Handbook* provisions, or other contract terms and conditions regarding environmental, safety and health compliance. Lockheed Martin shall not incur work stoppage charges unless the contractor demonstrates that the work stoppage was unwarranted for any of the reasons stated above. Any dispute regarding work stoppage charges must be resolved through binding arbitration.
- 1.12 Contractor is advised that the Project may be inspected from time to time by Lockheed Martin or a representative of Lockheed Martin. Periodic Lockheed Martin inspections in no way relieve the Contractor of their obligation to maintain its own inspection program to identify unsafe conditions or acts. ESH violations will be considered in evaluation of Contractor's performance.

- 1.13 Lockheed Martin is not responsible for training or supervising Contractor employees or abating workplace hazards created by the Contractor or to which the Contractor's employees are exposed.
- 1.14 Contractor agrees to maintain copies of all pertinent ESH records at the job site. Pertinent records include, but is not limited to, personnel training documentation, evidence of enrollment in a medical surveillance program, accident/injury reporting, work area inspections, periodic safety meetings, MSDS's, air monitoring data, waste container inspections, etc. These records shall also be provided electronically to the Lockheed Martin Project Lead.
- 1.15 Contractor shall contact the Lockheed Martin Project Lead immediately in the event of a fatal or serious injury, an unpermitted environmental release, or any ESH incident that is likely to generate significant publicity or an adverse situation for Lockheed Martin (e.g., alleged releases of contaminants beyond property boundaries, purported fish or wildlife impacts, allegations of adverse community health or property impacts, etc.)

2 DEFINITION

- 2.1 Contractor: any agent/agency engaged by Lockheed Martin through written contract (or other written agreement) to perform work on Lockheed Martin Remediation Sites. For the purposes of this *Remediation Contractor's ESH Handbook*, "Contractor" shall also include Contractor's subcontractors at any tier.
- 2.2 EPA: the Environmental Protection Agency.
- 2.3 Fed/OSHA: the Federal Occupational Safety and Health Administration
- 2.4 Hazard Communication Program: a written program meeting the requirements of Title 29, Code of Federal Regulations, Section 1910.1200 - Hazard Communication.
- 2.5 Lockheed Martin: Lockheed Martin Corporation, Corporate Energy, Environment, Safety & Health
- 2.6 Lockheed Martin Project Lead: the Lockheed Martin Corporate Environment, Safety & Health individual that has been designated to manage a specific project.
- 2.7 Lockheed Martin Contract Representative: the Lockheed Martin Corporate Environment, Safety & Health contract representative (Contract Administrator/Buyer) for the project.
- 2.8 RCRA: the Federal Resource Conservation and Recovery Act and all amendments or revisions.

SAFETY & HEALTH

Contractor shall comply with applicable provisions of Federal, State, municipal, local, and any other applicable occupational safety and health statutes, rules, ordinances, regulations and requirements. Contractor shall take all precautions for the protection of the safety and health of Contractor employees, subcontractor employees, and Lockheed Martin employees to prevent accidents or injury to them or to other persons on, about, or adjacent to site of work performance. Notwithstanding this handbook, Contractor will hold harmless Lockheed Martin for any incident, violation, regulatory agency inspection resulting in a finding, or any other ESH issue that occurs to a Contractor employee.

Within Section 3.0, Lockheed Martin is identifying specific requirements within the Federal regulations that need extra attention. These are not all encompassing and adherence to the all rules and regulations must be followed.

3.1 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT

1926 Subpart E or 1910 Subpart I
1910.139 / 1926.103
ANSI Z87.1
ANSI Z41 Standard
ANSI Z89.1 Standard

3.1.1 Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

- Eye Protection. Safety eyewear meeting ANSI Z87.1 shall be worn in areas designated as "Eye Protection Required" and on all jobs where a potential injury to the eyes is possible whether or not the area is posted.
- Foot Protection. Affected employee(s) shall wear protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee's feet are exposed to electrical hazards. Safety shoes and boots which meet the ANSI Z41 Standard shall be provided when impact and/or compression hazards exist. Soft-shoes, including but not limited to, tennis shoes, athletic shoes, moccasins, sandals, and open-toed or open-heeled shoes shall not be worn.
- Respiratory Protection Devices. Appropriate, MSHA/NIOSH-approved respiratory protective devices must be worn when applicable state and/or federal action levels or OSHA permissible exposure levels (PELs) are exceeded. Contractor must have fully implemented a respiratory protection program meeting the requirements of *Title 29, Code of Federal Regulations, Section 1910.139 / 1926.103* or applicable state OSHA regulations prior to issuing and using respiratory equipment. Contractor shall supply and maintain

appropriate air monitoring and respiratory protection equipment if inhalation hazards are anticipated.

- Protective Clothing such as suits, aprons, boots, or gloves shall be worn where there is a hazard to the body through dermal contact with chemicals, dusts, heat or other harmful agents or conditions.
- Hearing Protection (muffs and/or plugs) must be worn in all areas posted to indicate high noise level or where Contractor employees are exposed to noise levels in excess of the OSHA action level (85 dBA over a 8-hour time-weighted average or a dose of fifty percent).
- Hard Hats will be worn in all areas where there is a danger of impact to the head or hazard from falling or moving objects. Hard hats must meet the ANSI Z89.1 Standard.

3.1.2 Contractor will issue or cause to be issued prior to commencing the job all necessary personal protective equipment and air monitoring equipment to all its agents and employees, together with full instructions and training on the use of said equipment.

3.1.3 Contractor will meet all applicable Federal, State, municipal, local, and Lockheed Martin requirements for protective clothing and equipment. Contractor will properly supervise all its agents and employees to ensure protective clothing and equipment are used in conformance with applicable rules and regulations.

3.2 HAZARD COMMUNICATION - USE OF HAZARDOUS MATERIALS

Title 29, Code of Federal Regulations, Section 1926.59 Hazard Communication

Title 29, Code of Federal Regulations, Section 1910.1200 Hazard Communication

3.2.1 Contractor personnel shall not bring any hazardous substances (as defined by OSHA) onto Lockheed Martin remediation sites unless accompanied by a Material Safety Data Sheet (MSDS) and the containers are appropriately labeled. MSDS's must be maintained at the job site.

3.2.2 Contractor shall notify the Lockheed Martin Project Lead prior to bringing onto Lockheed Martin remediation sites any quantity of hazardous materials.

3.2.3 Contractor shall ensure all containers of hazardous materials are labeled in accordance with the Fed OSHA Hazard Communication Standard, 29 CFR 1910.1200 or applicable state OSHA standard.

3.2.4 Do not handle or use any hazardous material that does not have adequate safety warning labels.

3.2.5 Do not dump, drain or discharge any hazardous materials or wastes into any sink, drain or sewer.

3.2.6 The Lockheed Martin Project Lead shall inform the Contractor(s) of the identity of hazardous chemicals to which Contractor's employees may be exposed from

Lockheed Martin operations, if applicable. The Lockheed Martin Project Lead shall provide the following information:

- Where to obtain information concerning any hazardous substances used in Lockheed Martin operations that the Contractor's employees may come in contact with while performing their work;
- If Lockheed Martin owns or uses chemicals on a remediation site for any process where contractors could be exposed, Lockheed Martin shall make available to the Contractor Material Safety Data Sheets (MSDS) and sufficient information to permit the Contractor to train its employees on the hazards of the chemical. Appropriate protective measure Contractor employees may take to protect themselves from exposure to known hazards from Lockheed Martin operations; and
- Appropriate work practice procedures (safety rules) for the location where work is to be performed.

3.2.7 Contractor shall ensure its employees are trained in the safe handling and use of hazardous materials in accordance with *29 CFR 1910.1200 - Hazard Communication* or the applicable state-OSHA hazard communication standard.

3.2.8 Contractor shall ensure that all applicable employees are medically qualified (as defined by OSHA) to perform the work assigned.

3.2.9 Hazardous materials shall be stored in designated areas and all containers effectively closed. Spill equipment/supplies shall be readily available to contain and/or mitigate accidental spills of hazardous materials.

3.3 CONFINED SPACE ENTRY

Title 29, Code of Federal Regulations, Section 1910.146 Permit-Required Confined Spaces

3.3.1 If Contractor or any other employee must enter a confined space (tank, vat, pit, sewer, etc.), the entry must be performed in accordance with the applicable state OSHA or federal OSHA regulations.

3.3.2 Before Contractor's employees are permitted entry into any confined space, the internal atmosphere shall be tested with a calibrated direct-reading instrument for the following conditions in the order given: 1) Oxygen content, 2) Flammable gases & vapors, and 3) Potential toxic air contaminants. Contractor shall furnish the air testing equipment and a person competent in the use of the testing equipment.

3.3.3 When possible, the Contractor shall notify the Lockheed Martin Project Lead prior to entering a permit required confined space. A permit shall be issued by the contractor prior to entry and electronically submit a copy to the Lockheed Martin Project Lead.

- 3.3.4 To ensure the safety of Contractor personnel during entry into confined spaces, the Contractor shall have a written confined space entry program.

3.4 HOT WORK REQUIREMENTS (i.e., welding, torch cutting, brazing, etc.)

Title 29, Code of Federal Regulations, Section 1910 Subpart Q
Title 29, Code of Federal Regulations, Section 1926 Subpart J

- 3.4.1 All hot work activities shall be conducted in accordance with the hot work permit requirements outlined in the site specific HASP (i.e., fire suppression equipment availability, removal of combustibles, fire watch, etc.).
- 3.4.2 Contractor personnel must secure all oxygen and acetylene cylinders in a manner that will prevent them from falling or tipping over. Oxygen and acetylene cylinders must be stored separately. Oxygen cylinders in storage must be separated from fuel gas cylinders a distance of 20 feet or by a noncombustible barrier 5 feet high. Acetylene cylinders shall not be stored horizontally, lying on their side.
- 3.4.3 When welding, Contractor personnel shall use welding curtains and/or suitable protective devices to protect persons from indirect exposure to welding flashes.

3.5 LOCKOUT / TAGOUT - Control of Hazardous Energy

Title 29, Code of Federal Regulations, Section 1910.147

- 3.5.1 Contractors are required to establish a written program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start-up or release of stored energy in order to prevent injury to employee.
- 3.5.2 Contractor shall not service and/or maintain machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. Servicing and/or maintaining such equipment shall not be conducted until appropriate energy control methods have been initiated.
- The Contractor shall provide training to ensure that the purpose and function of the energy control program are understood by their employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by the employees.
- 3.5.3 If Contractor needs to service or maintain Lockheed Martin equipment, Contractor(s) shall notify the Lockheed Martin Project Lead and/or on-site facility operator (if applicable) of the intended equipment service for any unscheduled maintenance.
- 3.5.4 Upon completion of the job, Contractor is to notify the Lockheed Martin Project

Lead and/or on-site facility operator (if applicable) so power can be resumed to the equipment after the lock-outs and tags have been removed.

3.6 USE OF LOCKHEED MARTIN MATERIALS AND EQUIPMENT

- 3.6.1 Contractor's employees shall not use Lockheed Martin tools, equipment, materials, or personal protective equipment unless otherwise authorized by Lockheed Martin.
- 3.6.2 Contractor shall not start or stop any production equipment without the approval of the Lockheed Martin Project Lead.
- 3.6.3 Contractor shall not adjust or relocate any Lockheed Martin process equipment without the approval of the Lockheed Martin Project Lead.

3.7 DANGEROUS OPERATIONS - WARNINGS AND BARRICADES

Title 29, Code of Federal Regulations, Section 1926, Subpart G-Signs, signals and barricades

- 3.7.1 Contractor shall isolate their work areas from Lockheed Martin operations, employees, and the public by using barricades or other effective means of isolation. Signs, signals and barricades shall be visible at all times where a hazard exists.
- 3.7.2 Contractor personnel shall erect and properly maintain, at all times, all necessary safeguards for the protection of Contractor personnel, Lockheed Martin employees and the public. This includes:
 - If doing any overhead work, Contractor must utilize warning signs and barricades, or station someone on the ground to prevent passers-by from entering the area below the overhead work;
 - Contractor must effectively barricade excavations, floor openings, etc., as required by OSHA regulations;
 - Contractor must construct and maintain all scaffolds and working platforms in accordance with OSHA regulations; and
 - If Contractor's equipment, barricades or other safeguards restrict fire lanes or fire equipment access, the Contractor shall notify the Lockheed Martin Project Lead about its notification to the local fire department.
- 3.7.3 Prior to commencing work, Contractor must inform Lockheed Martin Project Lead of any work posing a potential danger to personnel.

3.8 EXCAVATIONS, TRENCHES, EARTHWORK

Title 29, Code of Federal Regulations, Section 1926 Subpart P

- 3.8.1 Review the Lockheed Martin intrusive fieldwork requirements in Appendix A.

- 3.8.2 If workers are to enter excavations, a competent person must be designated and trained in soil classification and the recognition of trenching and excavation hazards.
- 3.8.3 Excavations and trenches shall be inspected by a competent person daily and after every rainstorm, earthquake, or other hazard-increasing occurrence.
- 3.8.4 Inspect the face, banks, and top daily when workers are exposed to falling or rolling materials.
- 3.8.5 Shore, bench, slope, or use equivalent methods to protect workers in excavations four feet deep or more.
- 3.8.6 Locate soil at least two feet from the edge of the excavation, or one foot from the edge when the excavation is less than five feet deep.
- 3.8.7 Ladders or steps shall be provided and secured in all trenches four feet or more in depth. Ladders shall be located to require no more than twenty-five feet of lateral travel before having access or egress and shall extend three feet above the top of the trench bank.
- 3.8.8 Install crossings with standard guardrails and toeboards when the excavation is more than 7½ feet deep.
- 3.8.9 All open trenches and other excavations shall be provided with suitable barriers, signs, and lights to the extent that adequate protection is provided to the public.
- 3.8.10 Do not excavate beneath the level of adjacent foundations, retaining walls, or other structures until a qualified person has determined that the work will not be hazardous. Support undermined sidewalks.

3.9 ELECTRICAL SAFETY

Title 29, Code of Federal Regulations, Section 1926 Subpart K-Electrical
Title 29, Code of Federal Regulations, Section 1910.269 Electrical Power
Generation, Transmission and Distribution

- 3.9.1 Only qualified persons are permitted to work on electrical systems, as defined by *Title 29, Code of Federal Regulations Section 1910.269(a)(2)*. Qualified persons shall be trained and competent in:
- The skills and techniques necessary to distinguish exposed live parts from other parts of electrical equipment;
 - The skills and techniques necessary to determine the nominal voltage of exposed live parts;
 - The minimum approach distances specified by OSHA corresponding to the voltages to which the qualified employee will be exposed; and

- The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment.
- 3.9.2 Contractor personnel shall properly ground all electrical tools, mechanical digging or concrete breaking equipment and all other electrical equipment while in use.
- 3.9.3 All electrical work, installation and wire capacities shall be in accordance with the pertinent provisions of the National Electrical Code, ANSI and OSHA.
- 3.9.4 Covers or barriers must be installed on boxes, fittings, and enclosures to prevent accidental contact with live parts.
- 3.9.5 Temporary wiring installations must be grounded.
- 3.9.6 Electrical systems shall be de-energized utilizing appropriate lockout/tagout procedures prior to conducting work.
- 3.10 ELEVATED LOCATIONS / FALL PROTECT
 Cal/OSHA General Industry Safety Orders, 8 CCR 3210
 Title 29, Code of Federal Regulations, Section 1926 Subpart M – Fall Protection
 - 3.10.1 California employers: Guardrails shall be provided on all open sides of unenclosed room openings, open and glazed sides of landings, balconies or porches, platforms, runways, ramps, or working levels more than 30 inches above the floor, ground, or other working areas. The railing must be provided with a toeboard where the platform, runway, or ramp is 6 feet or more above places where employees normally work or pass and the lack of a toeboard could create a hazard from falling tools, material, or equipment.
 - 3.10.2 Contractor must provide fall protection systems whenever a worker is exposed to a fall of four feet or more (in construction the threshold is six feet). Guardrails are the most common forms of fall protection systems. If guardrail systems are not feasible, safety nets, personal fall arrest systems, positioning device systems, warning line systems, or some other demonstrated, effective means of fall protection shall be used. Fall protection systems and devices shall be inspected prior to each use Title 29, Code of Federal Regulations, Section 1926 Subpart M.
- 3.11 LADDERS
 Title 29, Code of Federal Regulations, Section 1910 Subpart D – Walking and Working Surfaces
 Title 29, Code of Federal Regulations, Section 1926 Subpart X - Ladders
 - 3.11.1 The use of ladders with broken or missing rungs or steps, broken or split rails or other defective construction is prohibited.
 - 3.11.2 Ladders shall extend no less than 36 inches above landing and be secured to

prevent displacement.

3.11.3 Portable ladders must be equipped with safety shoes.

3.11.4 Wooden ladders shall not be painted.

3.11.5 Do not use metal ladders for electrical work or near live electrical parts.

3.12 SCAFFOLDS

Title 29, Code of Federal Regulations, Section 1910.28 – Safety Requirements for Scaffolding

Title 29, Code of Federal Regulations, Section 1926 Subpart L - Scaffolds

3.12.1 Scaffolds must be provided for all work that cannot be done safely by employees standing on solid construction at least 20 inches wide, except where such work can be safely done from ladders.

3.12.2 Erection and dismantling of scaffolds shall be performed in accordance with good engineering practice.

3.12.3 Footings or anchorage for any scaffold shall be sound, rigid and capable of carrying the maximum intended load without settling or displacement.

3.12.4 No unstable objects such as concrete blocks shall be used to support scaffolds or planks.

3.12.5 Any part of a scaffold weakened or damaged shall be repaired or replaced immediately.

3.12.6 All scaffold planking shall be free of knots and cracks (Class A number) and shall completely cover the work platform.

3.12.7 Scaffold planks shall be laid tight, cleated at both ends or overlapped a minimum of 12 inches and nailed or bolted to prevent movement. Overlaps to occur directly above scaffold supports.

3.12.8 A safe and unobstructed means of access, such as a walkway, stair, or ladder shall be provided to all scaffold platforms.

3.13 HEAVY EQUIPMENT, INDUSTRIAL VEHICLES, AND CRANES

Title 29, Code of Federal Regulations, Section 1926 Subparts N, O and W

3.13.1 Only trained and authorized workers may operate heavy equipment, industrial vehicles, and/or cranes.

3.13.2 The Contractor shall designate a competent person who shall inspect all machinery and equipment prior to each use to make sure it is in safe operating condition.

- 3.13.3 The Contractor shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all heavy equipment, industrial vehicles, and cranes.
- 3.13.4 Seatbelts are required to be worn if the vehicle has Roll-Over Protection Structures (ROPS).
- 3.13.5 The swing radius of cranes shall be barricaded.
- 3.13.6 Equipment shall not be lubricated while in use.
- 3.13.7 Rated load capabilities, recommended operating speeds, special hazard warning, specific hand signal diagrams and special instructions shall be visible to the operator while he is at the control station.
- 3.13.8 Contractor's employees shall not be allowed to work under the load of cranes. Tag lines shall be used on all loads.

3.14 OVERHEAD POWER LINES

Title 29, Code of Federal Regulations, Section 1926.550 (a) (15)

- 3.14.1 If work is to be performed near overhead power lines, the lines must be de-energized and grounded by the owner or operator of the lines, or other protective measures must be provided before work is started. Protective measures (such as guarding or insulating the lines) must be designed to prevent employees from contacting the lines.
- 3.14.2 Unqualified employees and mechanical equipment must stay at least 10 feet away from overhead power lines. If the voltage is over 50,000 volts, the clearance should be increased by four inches for each additional 10,000 volts.
- 3.14.3 When mechanical equipment is being operated near overhead lines, employees standing on the ground may not contact the equipment unless it is located so that the required clearance cannot be violated even at the maximum reach of the equipment.
- 3.14.4 A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.
- 3.14.5 Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicates that it is not energized.

3.15 FIRE PREVENTION / FLAMMABLE LIQUIDS

Title 29, Code of Federal Regulations, Section 1926 Subpart F or 1910 Subpart E

- 3.15.1 Contractor shall be responsible for fire protection in its work and operational areas,

including offices, tool rooms, and storage areas 24 hours per day, seven days per week through the duration of this Contract. Approved fire-fighting equipment, in adequate quantities, must be provided.

- 3.15.2 Contractor shall familiarize Contractor's employees with the locations of fire extinguishers in their respective work areas and ensure they are prepared to use them safely if necessary. In certain remote field locations or within abandoned (discontinued) facilities where fire extinguishers may not exist in the immediate work area, contractor shall provide and locate fire extinguisher(s) in close proximity to the active work area(s).
- 3.15.3 In case of fire, Contractor shall call 9-1-1. Contractor shall also inform all Contractor and Lockheed Martin employees in the area to evacuate to a safe place and direct arriving fire response personnel to the fire. Notify the Lockheed Martin Project Lead as soon as reasonably possible.
- 3.15.4 Contractor employees shall only attempt to put out a fire when such action can be performed safely.
- 3.15.5 If a Contractor employee uses a Lockheed Martin fire extinguisher, Contractor shall report its use to the Lockheed Martin Project Lead.
- 3.15.6 Contractor shall report all fires extinguished by the Contractor to the Lockheed Martin Project Lead.
- 3.15.7 Contractors are to store, dispense, and use flammable and combustible liquids in accordance with OSHA regulations and the Uniform Fire Code. Bonding and grounding of containers containing flammable liquids will be required.
- 3.15.8 Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas.
- 3.15.9 Contractor shall provide sufficient fire extinguishers necessary for their work activities.

3.16 HAND AND POWER TOOLS

Title 29, Code of Federal Regulations, Section 1910 Subpart P – Hand and Portable Powered Tools and Other Hand-Held Equipment

Title 29, Code of Federal Regulations, section 1926 Subpart I – Tools Hand and Power

- 3.16.1 All hand and power tools, whether furnished by Contractor, or by Contractor's employee, shall be maintained in a safe condition.
- 3.16.2 Electrical power tools shall be grounded or double insulated with proper assured equipment grounding inspections or Ground Fault Interrupter (GFI) circuit protection provided.

- 3.16.3 Pneumatic power tools shall be secured to the hose or whip by some positive means.
- 3.16.4 Only properly trained Contractor employees shall operate power-actuated tools.
- 3.16.5 All grinding machines shall conform to OSHA and ANSI requirements.

3.17 COMPRESSED GAS CYLINDERS

Title 29, Code of Federal Regulations, Section 1910.101 – Compressed Gases
Title 29, Code of Federal Regulations, Section 1926.350 – Gas Welding and Cutting

- 3.17.1 Compressed gas cylinders shall be secured in an upright position at all times.
- 3.17.2 When transporting, moving and storing cylinders, valve protection caps shall be in place and secured.
- 3.17.3 Compressed gas cylinders shall be kept away from excessive heat, shall not be stored where they might be damaged or knocked over by passing or falling objects, and shall be stored at least 20 feet away from highly combustible materials.
- 3.17.4 Cylinders shall be labeled as to the nature of their contents.
- 3.17.5 Oxygen cylinders in storage shall be separated from fuel gas cylinders or combustible materials a minimum of 20 feet or by a noncombustible barrier at least five feet high having a fire-resistant rating of at least one-half hour.
- 3.17.6 Acetylene cylinders shall be stored and used in a vertical, valve-end-up position only.
- 3.17.7 Anti-flashback arrestors shall be installed on all oxygen and acetylene cylinders.

3.18 INCIDENTAL CONTACT WITH ASBESTOS

- 3.18.1 This section applies to all contractors who incidentally disrupt the matrix of asbestos containing material (ACM) or presumed asbestos containing material (PACM); i.e., contractors who have not been specifically hired to perform ACM abatement.
- 3.18.2 Contractor shall immediately report to the Lockheed Martin Project Lead and to other employers of employees working at the job site any discovery, disturbance, and/or spill of ACM and/or PACM. Contractor(s) is to cease all operations in the immediate area of the suspect ACM and/or PACM and demarcate the area. The approval of the Lockheed Martin Project Lead is required before resuming operations.

- 3.18.3 Contractor shall not disturb any pipe insulation, boiler insulation, or any other material reasonably suspected of containing asbestos until the Contractor notifies the Lockheed Martin Project Lead. Lockheed Martin approval is required before operations may commence.
- 3.18.4 Abatement of asbestos can be performed only by persons properly trained and licensed to perform such activities

3.19 ASBESTOS ABATEMENT CONTRACTORS

- 3.19.1 This section applies to Contractors performing maintenance, construction, repair, renovation, demolition, salvage, or any other operation in which any material containing more than 1% asbestos is sanded, abrasive blasted, sawed, shoveled, removed, or otherwise handled in a manner that would generate airborne asbestos fibers. These requirements are in addition to any requirements contained in Contractor's scope of work.
- 3.19.2 All Contractors working with asbestos shall comply with applicable federal and state OSHA, EPA, local air district, and other applicable Federal, State, municipal, and local statutes, regulations, rules, and ordinances; and specific contract terms and conditions regarding the handling of, use of, and work involving asbestos.
- 3.19.3 The contractor shall ensure that a competent person, as defined by OSHA supervises all asbestos work performed within regulated areas.
- 3.19.4 Before commencing work, all asbestos abatement contractors shall supply to Lockheed Martin proof of:
- Asbestos abatement contractor certification by the state Contractor's License Board
 - Liability insurance for Contractor employees engaged in asbestos work operations
 - Copies of asbestos work notification letters to state OSHA
 - Local air district Asbestos Demolition/Renovation Notification
- 3.19.5 Contractors shall minimize the creation and spread of airborne asbestos fibers by using appropriate work practices, engineering controls, and established procedures (i.e., wet methods, HEPA filter vacuums, negative pressure enclosure, local exhaust ventilation equipped with HEPA filter dust collection system, etc.).
- 3.19.6 All Class I, II and III asbestos work shall be conducted within regulated areas. The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Signs shall be provided and displayed at each location where a regulated area is required to be established. Signs shall be posted at such a distance from such a location that an employee may read the signs

and take necessary protective steps before entering the area marked by the signs. Warning signs shall bear the following information:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY

3.19.7 On multiple employer worksites requiring the establishment of a regulated area, the asbestos Contractor shall inform other employers on the site of the nature of the work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

3.19.8 Contractors shall package and label asbestos waste in accordance with federal and or applicable state OSHA requirements and federal or applicable state hazardous waste regulations. Labels shall be affixed to all products containing asbestos and to all containers containing such products, including waste containers. Labels shall be printed in large, bold letters on a contrasting background and shall contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

3.19.9 Contractors shall properly dispose of all asbestos waste. Proper disposal includes the use of hazardous waste manifests and Lockheed Martin approved and licensed waste haulers, and disposal facilities according to federal RCRA law and applicable state hazardous waste regulations. Contractor shall contact the Lockheed Martin Project Lead before transporting or disposing of any hazardous waste. Lockheed Martin must review all hazardous waste manifests prior to shipment.

3.19.10 Contractors shall ensure that employee exposure air monitoring is conducted as required by federal or applicable state OSHA regulations. All other air monitoring (i.e. clearance sampling) shall be conducted by a third-party contracted air monitoring firm not affiliated with the Contractor.

3.19.11 Contractor shall, at no cost to the employee, institute a training program for and ensure the participation of all employees engaged in asbestos-related work who may reasonably be expected to be exposed to asbestos fibers from asbestos containing construction materials.

3.19.12 Contractor shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos at or above the TWA and/or excursion limit.

3.20 HAZARDOUS WASTE OPERATIONS and EMERGENCY RESPONSE
(HAZWOPER)

Title 29, Code of Federal Regulations, Section 1910.120 - Hazardous Waste Operations and Emergency Response

Title 29, Code of Federal Regulations, Section 1926.65 – Hazardous Waste Operations and Emergency Response

This section applies to Contractors performing hazardous waste-type activities. This includes operations that pose a potential or reasonable possibility for employee exposure to hazardous waste/chemical contaminants during site investigations, clean-up operations, abatement, or hazardous substance removal work (remedial actions). These requirements are in addition to any requirements contained in Contractor's scope of work.

- 3.20.1 Contractor shall provide a **site-specific safety and health plan** at least two (2) weeks prior to field mobilization to the Lockheed Martin Project Lead (global statement – move to the beginning).

Contractor shall provide a **safety and health plan** in accordance with *Title 29, Code of Federal Regulations, Section 1910.120 - Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard and, at a minimum, shall contain the following elements:

- Safety and health risk or hazard analysis for each anticipated site task
- Employee training requirements
- Personal protective equipment to be used by employees for each of the site tasks and operations
- Medical surveillance requirements
- Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used
- Site control measures
- Decontamination requirements and procedures
- Emergency response plan
- Confined space procedures (if applicable)
- Emergency response plan
- Confined space procedures (if applicable)
- Spill containment program
- Periodic documented safety meetings
- Periodic documented work area safety inspections and corrective actions

- 3.20.2 Contractors performing hazardous waste-type operations shall adhere to the requirements specified in *29 CFR 1910.120 - Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard.

- 3.20.3 Training: All Contractor and subcontractor employees working on site who are potentially exposed to hazardous substances shall receive initial and annual

refresher training in accordance with *29 CFR 1910.120(e) – Hazardous Waste Operations and Emergency Response* or the applicable state OSHA standard. Lockheed Martin shall be provided with electronic copies of the training certificates.

- 3.20.4 Medical Surveillance: Contractor employees must be enrolled in a medical surveillance program prior to performing hazardous waste operations. Upon Lockheed Martin request, Contractor shall provide evidence of employee enrollment in a medical surveillance program. Lockheed Martin does not provide medical surveillance examinations to Contractor employees.
- 3.20.5 Periodic work area inspections: Contractor agrees to perform periodic work area inspections to determine the effectiveness of the site safety and health plan and to identify and correct unsafe conditions in contractor's responsible work area. These inspections shall be documented and available to Lockheed Martin upon request for review.

3.21 MANAGEMENT OF NANOTECHNOLOGY

- 3.21.1 The Lockheed Martin Project Lead shall work with the designated contractor responsible for nanotechnology to implement this procedure and ensure areas where nanomaterials (materials incorporating engineered nanoparticles or nanoscale features that exhibit unique physical and chemical properties as a result of the nanoparticles or nanoscale features) will be used meet engineering control requirements of this procedure.
- 3.21.2 The contractor shall ensure that the safety and environmental hazards of nanomaterials are managed as described in the requirements of this section.
- 3.21.3 A plan must be developed and executed that addresses the following requirements:
- 3.21.3.1 **Hazard Analysis:** Identify potential adverse health effects and environmental impacts that could result from the chemical and physical properties exhibited by the nanomaterials and/or nanoparticles in use, to be used, under development, or to be developed at the site.
 - 3.21.3.2 **Exposure Assessment:** Evaluate all tasks involving nanomaterials and identify where exposures could occur. The evaluation must include at a minimum, an evaluation of materials; chemical intermediates; by-products; end-products; waste products; processes; process equipment; the amount of material used; material form; degree of containment; duration of use; and work space including laboratory and manufacturing space.
 - 3.21.3.3 **Exposure Control**
 - Implement appropriate controls to mitigate worker exposure and environmental emissions identified in sections 3.21.2.1 and 3.21.2.2 of this procedure.

- Implement Control Bands as indicated on the Control Band Matrix below.

Exposure Duration	Bound Materials	Potential Release	Free / Unbound
Hazard Group A (Known to be inert)			
Short	1	1	2
Medium	1	1	2
Long	1	2	2
Hazard Group B (Understand reactivity/function)			
Short	1	2	2
Medium	1	2	3
Long	1	3	3
Hazard Group C (Unknown Properties)			
Short	2	2	3
Medium	2	3	4
Long	2	4	4

Duration Key:

Short - Less than 4 hrs/day; 2 days/week

Medium - Between 4 to 6 hrs/day; 3 to 5 days/week

Long - 6 to > 8 hrs/day; 3 to 5 days/week

Release Key:

Bound Materials: Nanoparticles in a solid matrix e.g. polycarbonate

Potential Release: Nanoparticles in friable or solgel matrix

Free / Unbound: Nanoparticles unbound, not aggregated

Control Band:

1. General Ventilation and PPE

2. Engineering Controls and/or Respirators and additional PPE

3. Containment e.g. glove box

4. Specialist Advise

- Establish designated areas for Control Banding. The designated area shall, at a minimum, include warning signs informing employees that they are entering a nanomaterial work area as well as signs specifying administrative controls and personal protective equipment (PPE) required for entry.
- Identify appropriate administrative controls (e.g. good housekeeping methods, HEPA vacuums, wet wipe methods, employee training, safe work practices), engineering controls (e.g. containment, exhaust ventilation) and Personal Protective Equipment (e.g. respiratory protection, protective coveralls, gloves, goggles) based on Control Band and best industry practices.
- Develop and execute procedures for housekeeping, including clean-as-you-go practices that do not re-suspend particles.
- Develop and execute procedures for management of nanomaterial-associated waste.

4

ENVIRONMENTAL

Contractors shall comply with all applicable provisions of Federal, State, municipal, local, and other environmental statutes, rules, and regulations. Contractor shall take all necessary precautions to protect the environment. Contractor shall also store, transport, dispose, or otherwise handle hazardous wastes and non-hazardous wastes to prevent discharges of materials into the environment except in accordance with applicable governmental regulations.

4.1 HAZARD COMMUNICATION - USE OF HAZARDOUS MATERIALS

- 4.1.1 Contractor shall develop a Waste Management Plan in accordance with the requirements outlined in the LMC Remediation Waste Management Procedure in

Appendix B. Lockheed Martin shall approve the Waste Management Plan prior to work commencement.

- 4.1.2 Contractor must segregate hazardous from non-hazardous waste; all hazardous waste generated by its operations must be labeled in accordance with all governmental regulations.
- 4.1.3 Contractor shall dispose of all hazardous waste within the time frame stipulated by local, state, or federal regulations. Contractor shall not leave behind on Lockheed Martin remediation sites any containers of hazardous materials or waste (including drums, roll-offs, maintenance chemicals, etc.), empty or not, after the termination of operations.
- 4.1.4 In case of a spill or release of hazardous materials or waste, Contractor shall immediately notify the Lockheed Martin Project Lead and if the severity of the spill warrants, notify the local fire department (Call 9-1-1). The Contractor shall be liable for the costs of any spill resulting from Contractor's actions, including, but not limited to, costs of containment, cleanup, and disposal.

4.2 NON-HAZARDOUS WASTE DISPOSAL

- 4.2.1 Contractor shall develop a Waste Management Plan in accordance with the requirements outlined in the LMC Remediation Waste Management Procedure in Appendix B. This plan must be approved by the Lockheed Martin Project Lead.

4.3 WORK INVOLVING AIR EMISSIONS

- 4.3.1 Contractor shall work with the Lockheed Martin Project Lead to identify applicable Federal, state, and/or local permit application requirements for air emission sources (i.e., stationary point source, fugitive emissions, etc.) associated with the anticipated project.
- 4.3.2 Contractor shall submit permit applications and/or notifications to the Lockheed Martin Project Lead for review prior to submittal to the applicable regulatory agency.
- 4.3.3 Contractor shall abide by the requirements of the permit(s) and gather emissions data (as applicable) to document compliance. This data shall be electronically submitted to the Lockheed Martin Project Lead.
- 4.3.4 Contractor shall immediately contact the Lockheed Martin Project Lead in the event permit conditions are not met.
- 4.3.5 Ensure permits are posted on permitted equipment (or in close proximity) as required by the respective permit.

4.4 WORK INVOLVING WATER DISCHARGES

- 4.4.1 At no time is an unauthorized, unpermitted release allowed. Contractor shall notify the Lockheed Martin Project Lead in the event of a release and obtain the approval of Lockheed Martin before discharging any material into storm drains or sewers.
- 4.4.2 Contractor shall work with the Lockheed Martin Project Lead to identify applicable National Pollutant Discharge Elimination System (NPDES), Stormwater Pollution Prevention Plans (SWPPP), and POTW requirements associated with the anticipated project.
- 4.4.3 Contractor shall submit permit applications and/or Notice of Intent forms to the Lockheed Martin Project Lead for review prior to submittal to the applicable regulatory agency.
- 4.4.4 Contractor shall abide by the requirements of the discharge permit(s) and maintain discharge monitoring information and inspection data to document compliance. This documentation shall be electronically provided to the Lockheed Martin Project Lead.
- 4.4.5 Contractor shall immediately contact the Lockheed Martin Project Lead in the event permit conditions are not met.

5 HOUSEKEEPING / CLEANUP

- 5.1 Ensure discharge permits and/or SWPPP plans (as applicable) are available at the project job site.
- 5.2 Contractor shall continuously clean up its respective work area(s). Contractor shall maintain its work areas free from all slip, trip, and fall hazards at all times.
- 5.3 Debris shall be kept cleared from work areas, passageways, stairs, and in and around buildings or other structures. The work area must be left free from accumulation of waste and rubbish at the end of each work shift.
- 5.4 Combustible scrap and debris shall be removed at regular intervals during the course of work performed by Contractor. Safe means shall be provided to facilitate such removal.
- 5.5 At the end of each working day and/or the conclusion of work being performed, Contractor shall restore the work area to the same degree of neatness as when work commenced.
- 5.6 Contractor shall furnish necessary equipment and/or receptacles to remove waste and rubbish from the job site unless otherwise specified by the Lockheed Martin.

6 CHANGE MANAGEMENT

If deviations are encountered from the field work plan, the contractor shall A) notify to the Lockheed Martin Project Lead and B) suspend work to assess changes to the work plan(s) and the HASP. Changes to the work plan(s) and the HASP shall be reviewed by the PL.

7 REQUIREMENT TO PERFORM & DOCUMENT SELF-AUDITS

- 7.1 Contractor agrees to perform periodic work area/project field inspections to monitor compliance with project environmental, safety and health (ESH) requirements. The name of Contractor's jobsite ESH representative will be provided to Lockheed Martin prior to the Contractor starting work at the jobsite.
- 7.2 For jobs that are ongoing, an annual ESH audit shall be conducted and for jobs with a duration of less than one year at least one audit shall occur. A competent ESH representative designated by the Contractor shall perform the audit. Unsafe acts and/or non-compliance conditions noted during inspections shall be corrected immediately.
- 7.3 The documentation related to the audits and inspections shall be submitted electronically to the Lockheed Martin Project Lead.

8 ACCIDENT, INJURY, ILLNESS, INCIDENT and SPILL REPORTING

- 8.1 Contractor shall immediately contact the Lockheed Martin Project Lead and/or Lockheed Martin Safety & Health Manager in the event of a fatality, injury, environmental release (spill), near-miss incident, or any ESH incident that is likely to generate significant publicity. A written report of the incident/injury/spill and corrective action(s) taken shall be submitted to the Lockheed Martin Project Lead within one (1) day of the incident. Representatives from Lockheed Martin may conduct joint investigations with the contractor if deemed necessary.
- 8.2 In case of a spill or release of hazardous chemicals, Contractor shall immediately notify the Lockheed Martin Project Lead, and/or if the severity of the spill warrants, the local fire department by calling 9-1-1. Contractor shall take all necessary steps to control the spread of the release and to provide site control to prevent unauthorized personnel from entering the affected area. The Contractor shall be liable for the costs of any spill resulting from Contractor's actions, including, but not limited to, costs of containment, cleanup, and disposal.

9 FINES, PENALTIES AND COSTS

- 9.1 Contractor shall indemnify and hold Lockheed Martin harmless from any and all liability (including but not limited to fines and penalties), loss, cost, damage, or expense (including attorney's fees) suffered or incurred by Lockheed Martin by reason of Contractor's failure to comply with Federal, State, municipal, local or other laws, rules, regulations, ordinances and requirements, or failure to comply with generally accepted environmental safety and health practices.

10

LOCKHEED MARTIN ESH MANAGER

- 10.1 The Lockheed Martin ESH Manager is Jimmy Yeager. Contact Jimmy regarding any questions or concerns at (301) 873-1444 or via email at james.l.yeager@lmco.com.

Appendix A – LMC Requirements for Invasive Fieldwork



LMC Minimum
Requirements for Inv

Appendix B – LMC Waste Management Procedure



LMC Waste Mgmt
Procedure Rev 4



CONTRACTOR'S ESH HANDBOOK

COMPLIANCE AGREEMENT

The Key National Contractor Program Manager has read and understands the contents of the *Contractor's ESH Handbook*. Contractor agrees while performing work on Lockheed Martin-owned or Lockheed Martin-controlled premises, that the Contractor shall require its employees and subcontractors at any tier to comply with the contents of this *Contractor's ESH Handbook* and the job specific HASP. A copy of the HASP shall be maintained at the job site and made readily available to contractor and subcontractor employees for their information. All contractor employees and subcontractors shall read and certify that they have read and understand the job specific health and safety plan (HASP). The certification forms shall be electronically sent to the Lockheed Martin Project Lead.

I further understand that this handbook and the rules and regulations it contains do not in any way relieve the Contractor (employer) of its responsibility to comply with the applicable environmental safety and health (ESH) regulations and its obligation to implement and enforce its own written ESH programs while working on this project.

Company: _____

Name: _____

Signature: _____

Title: _____

Date: _____

COMPLETE, SIGN AND RETURN THIS CERTIFICATE TO THE LOCKHEED MARTIN
ESH MANAGER.

ATTACHMENT II
INCIDENT REPORT FORM

Report Date	Report Prepared By	Incident Report Number
<p><u>INSTRUCTIONS:</u></p> <p>All incidents (including those involving subcontractors under direct supervision of Tetra Tech personnel) must be documented on the IR Form.</p> <p>Complete any additional parts to this form as indicated below for the type of incident selected.</p>		
TYPE OF INCIDENT (Check all that apply)		Additional Form(s) Required for this type of incident
Near Miss (No losses, but could have resulted in injury, illness, or damage)		<input type="checkbox"/> Complete IR Form Only
Injury or Illness		<input type="checkbox"/> Complete Form IR-A; Injury or Illness
Property or Equipment Damage, Fire, Spill or Release		<input type="checkbox"/> Complete Form IR-B; Damage, Fire, Spill or Release
Motor Vehicle		<input type="checkbox"/> Complete Form IR-C; Motor Vehicle
INFORMATION ABOUT THE INCIDENT		
Description of Incident		
<div style="border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black; margin-bottom: 5px;"></div> <div style="border-bottom: 1px solid black;"></div>		
Date of Incident		Time of Incident
		_____ AM <input type="checkbox"/> PM <input type="checkbox"/> OR Cannot be determined <input type="checkbox"/>
Weather conditions at the time of the incident		Was there adequate lighting?
		_____ Yes <input type="checkbox"/> No <input type="checkbox"/>
Location of Incident		
Was location of incident within the employer's work environment? Yes <input type="checkbox"/> No <input type="checkbox"/>		
Street Address		City, State, Zip Code and Country
Project Name / Project #		Client:
Tt Supervisor or Project Manager		Was supervisor on the scene?
		Yes <input type="checkbox"/> No <input type="checkbox"/>
WITNESS INFORMATION (attach additional sheets if necessary)		
Name		Company
Street Address		City, State and Zip Code
Telephone Number(s)		

CORRECTIVE ACTIONS				
Corrective action(s) immediately taken by unit reporting the incident:				
Corrective action(s) still to be taken (by whom and when):				
ROOT CAUSE ANALYSIS LEVEL REQUIRED				
Root Cause Analysis Level Required: Level - 1 <input type="checkbox"/> Level - 2 <input type="checkbox"/> None <input type="checkbox"/>				
Root Cause Analysis Level Definitions				
Level - 1	<p>Definition: A Level 1 RCA is conducted by an individual(s) with experience or training in root cause analysis techniques and will conduct or direct documentation reviews, site investigation, witness and affected employee interviews, and identify corrective actions. Activating a Level 1 RCA and identifying RCA team members will be at the discretion of the Corporate Administration office.</p> <p>The following events may trigger a Level 1 RCA:</p> <ul style="list-style-type: none"> Work related fatality Hospitalization of one or more employee where injuries result in total or partial permanent disability Property damage in excess of \$75,000 When requested by senior management 			
Level - 2	<p>Definition: A Level 2 RCA is self performed within the operating unit by supervisory personnel with assistance of the operating unit HSR. Level 2 RCA will utilize the 5 Why RCA methodology and document the findings on the tools provided.</p> <p>The following events will require a Level 2 RCA:</p> <ul style="list-style-type: none"> OSHA recordable lost time incident Near miss incident that could have triggered a Level 1 RCA When requested by senior management 			
Complete the Root Cause Analysis Worksheet and Corrective Action form. Identify a corrective action(s) for each root cause identified within each area of inquiry.				
NOTIFICATIONS				
Title	Printed Name	Signature	Telephone Number	Date
Project Manager or Supervisor				
Site Safety Coordinator or Office H&S Representative				
Operating Unit H&S Representative				
Other: _____				

The signatures provided above indicate that appropriate personnel have been notified of the incident.

INSTRUCTIONS:

Complete all sections below for incidents involving injury or illness.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

EMPLOYEE INFORMATION**Company Affiliation**Tetra Tech Employee? ☐TetraTech subcontractor employee (directly supervised by Tt personnel)? ☐**Full Name****Company (if not Tt employee)****Street Address, City, State and Zip Code****Address Type**Home address (for Tt employees) ☐Business address (for subcontractors) ☐**Telephone Numbers**

Work: _____

Home: _____

Cell: _____

Occupation (regular job title)**Department****Was the individual performing regular job duties?****Time individual began work**Yes ☐ No ☐_____ AM ☐ PM ☐ OR Cannot be determined ☐**Safety equipment**Provided? Yes ☐ No ☐Type(s) provided: ☐ Hard hat ☐ Protective clothingUsed? Yes ☐ No ☐ If no, explain why☐ Gloves ☐ High visibility vest☐ Eye protection ☐ Fall protection☐ Safety shoes ☐ Machine guarding☐ Respirator ☐ Other (list)**NOTIFICATIONS****Name of Tt employee to whom the injury or illness was first reported****Was H&S notified within one hour of injury or illness?**Yes ☐ No ☐**Date of report****H&S Personnel Notified****Time of report****Time of Report****If subcontractor injury, did subcontractor's firm perform their own incident investigation?**Yes ☐ No ☐ If yes, request a copy of their completed investigation form/report and attach it to this report.

INJURY / ILLNESS DETAILS

What was the individual doing just before the incident occurred? Describe the activity as well as the tools, equipment, or material the individual was using. Be specific. Examples: "Climbing a ladder while carrying roofing materials"; "Spraying chlorine from a hand sprayer"; "Daily computer key-entry"

What Happened? Describe how the injury occurred. Examples: "When ladder slipped on wet floor and worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time"

Describe the object or substance that directly harmed the individual: Examples: "Concrete floor"; "Chlorine"; "Radial Arm Saw". If this question does not apply to the incident, write "Not Applicable".

MEDICAL CARE PROVIDED

Was first aid provided at the site: Yes ☐ No ☐ If yes, describe the type of first aid administered and by whom?

Was treatment provided away from the site: Yes ☐ No ☐ If yes, provide the information below.

Name of physician or health care professional

Facility Name

Street Address, City State and Zip Code

Type of Care?

Was individual treated in emergency room? Yes ☐ No ☐

Was individual hospitalized overnight as an in-patient? Yes ☐ No ☐

Telephone Number

Did the individual die? Yes ☐ No ☐ If yes, date: _____

Will a worker's compensation claim be filed? Yes ☐ No ☐

NOTE: Attach any police reports or related diagrams to this report.

SIGNATURES

I have reviewed this report and agree that all the supplied information is accurate

**Affected individual
(print)**

Affected individual (signature)

Telephone Number

Date

--	--	--	--

This form contains information relating to employee health and must be used in a manner that protects the confidentiality of the employee to the extent possible while the information is being used for occupational safety and health purposes.

INSTRUCTIONS:

Complete all sections below for incidents involving property/equipment damage, fire, spill or release.
Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

TYPE OF INCIDENT (Check all that apply)Property Damage ☐Equipment Damage ☐Fire or Explosion ☐Spill or Release ☐**INCIDENT DETAILS****Results of Incident:** Fully describe damages, losses, etc.

Response Actions Taken:

Responding Agency(s) (i.e. police, fire department, etc.)

Agency(s) Contact Name(s)

DAMAGED ITEMS (List all damaged items, extent of damage and estimated repair cost)

Item:	Extent of damage:	Estimated repair cost

SPILLS / RELEASES (Provide information for spilled/released materials)

Substance	Estimated quantity and duration	Specify Reportable Quantity (RQ)
		_____ Exceeded? Yes <input type="checkbox"/> No <input type="checkbox"/> NA <input type="checkbox"/>

FIRES / EXPLOSIONS (Provide information related to fires/explosions)Fire fighting equipment used? Yes ☐ No ☐ If yes, type of equipment: _____**NOTIFICATIONS**

Required notifications	Name of person notified	By whom	Date / Time
Client: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			
Agency: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			
Other: _____ Yes <input type="checkbox"/> No <input type="checkbox"/>			

Who is responsible for reporting incident to outside agency(s)? Tt ☐ Client ☐ Other ☐ Name: _____Was an additional written report on this incident generated? Yes ☐ No ☐ If yes, place in project file.

INSTRUCTIONS:

Complete all sections below for incidents involving motor vehicle accidents. Do NOT leave any blanks.
Attach this form to the IR FORM completed for this incident.

Incident Report Number: (From the IR Form)

INCIDENT DETAILS

Name of road, street, highway or location where accident occurred

Name of intersecting road, street or highway if applicable

County

City

State

Did police respond to the accident?

Yes ☐ No ☐

Did ambulance respond to the accident?

Yes ☐ No ☐

Name and location of responding police department

Ambulance company name and location

Officer's name/badge #

Did police complete an incident report? Yes ☐ No ☐ If yes, police report number: _____
Request a copy of completed investigation report and attach to this form.

VEHICLE INFORMATION

How many vehicles were involved in the accident? _____ (Attach additional sheets as applicable for accidents involving more than 2 vehicles.)

Vehicle Number 1 – Tetra Tech Vehicle**Vehicle Number 2 – Other Vehicle**Vehicle Owner /
Contact
InformationVehicle Owner /
Contact
Information

Color

Color

Make

Make

Model

Model

Year

Year

License Plate #

License Plate #

Identification #

Identification #

Describe damage to vehicle number 1

Describe damage to vehicle number 2

Insurance Company Name and Address

Insurance Company Name and Address

Agent Name

Agent Name

Agent Phone No.

Agent Phone No.

Policy Number

Policy Number

DRIVER INFORMATION							
Vehicle Number 1 – Tetra Tech Vehicle				Vehicle Number 2 – Other Vehicle			
Driver's Name				Driver's Name			
Driver's Address				Driver's Address			
Phone Number				Phone Number			
Date of Birth				Date of Birth			
Driver's License #				Driver's License #			
Licensing State				Licensing State			
Gender		Male <input type="checkbox"/> Female <input type="checkbox"/>		Gender		Male <input type="checkbox"/> Female <input type="checkbox"/>	
Was traffic citation issued to Tetra Tech driver? Yes <input type="checkbox"/> No <input type="checkbox"/>				Was traffic citation issued to driver of other vehicle? Yes <input type="checkbox"/> No <input type="checkbox"/>			
Citation #				Citation #			
Citation Description				Citation Description			
PASSENGERS IN VEHICLES (NON-INJURED)							
<p align="center">List all non-injured passengers (excluding driver) in each vehicle. Driver information is captured in the preceding section. Information related to persons injured in the accident (non-Tt employees) is captured in the section below on this form. Injured Tt employee information is captured on FORM IR-A</p>							
Vehicle Number 1 – Tetra Tech Vehicle				Vehicle Number 2 – Other Vehicle			
How many passengers (excluding driver) in the vehicle? ____				How many passengers (excluding driver) in the vehicle? ____			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
Non-Injured Passenger Name and Address				Non-Injured Passenger Name and Address			
INJURIES TO NON-TETRATECH EMPLOYEES							
Name of injured person 1				Address of injured person 1			
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?	
	Male <input type="checkbox"/> Female <input type="checkbox"/>			Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	Injured <input type="checkbox"/> Died <input type="checkbox"/>	
Name of injured person 2				Address of injured person 2			
Age	Gender	Car No.	Location in Car	Seat Belt Used?	Ejected from car?	Injury or Fatality?	
	Male <input type="checkbox"/> Female <input type="checkbox"/>			Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	Injured <input type="checkbox"/> Died <input type="checkbox"/>	
OTHER PROPERTY DAMAGE							
Describe damage to property other than motor vehicles							
Property Owner's Name				Property Owner's Address			

COMPLETE AND SUBMIT DIAGRAM DEPICTING WHAT HAPPENED

A large, empty rectangular box with a black border, intended for drawing a diagram. It occupies the majority of the page below the header.

ATTACHMENT III
MEDICAL DATA SHEET

MEDICAL DATA SHEET

This Medical Data Sheet must be completed by on-site personnel and kept in the command post during the conduct of site operations. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Person to notify in the event of an emergency: Name: _____

Phone: _____

Drug or other Allergies: _____

Particular Sensitivities : _____

Do You Wear Contacts? _____

What medications are you presently using? _____

Name, Address, and Phone Number of personal physician: _____

Note: Health Insurance Portability and Accountability Act (HIPAA) Requirements

HIPAA took effect April 14, 2003. Loosely interpreted, HIPAA regulates the disclosure of Protected Health Information (PHI) by the entity collecting that information. PHI is any information about health status (such as that you may report on this Medical Data Sheet), provision of health care, or other information. HIPAA also requires Tetra Tech to ensure the confidentiality of PHI. This Act can affect the ability of the Medical Data Sheet to contain and convey information you would want a Doctor to know if you were incapacitated. So before you complete the Medical Data Sheet understand that this form will not be maintained in a secure location. It will be maintained in a file box or binder accessible to other members of the field crew so that they can accompany an injured party to the hospital.

DO NOT include information that you do not wish others to know, only information that may be pertinent in an emergency situation or treatment.

Name (Print clearly)

Signature

Date

ATTACHMENT IV
SAFE WORK PERMITS

**SAFE WORK PERMIT
MOBILIZATION AND DEMOBILIZATION ACTIVITIES
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND**

Permit No. _____ Date: _____ Time: From _____ to _____

I. **Work limited to the following (description, area, equipment used):** Mobilization and demobilization activities

II. **Primary Hazards:** Lifting; slips, trips and falls; vehicular and foot traffic; insect/animal bites and stings; poisonous plants; inclement weather.

III. **Field Crew:** _____

IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. **Protective equipment required**

Level D ☒ Level B ☐

Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse

No ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, or coveralls, safety glasses and safety footwear. Hard hats and hearing protection will be worn when working near operating equipment.

VI. **Chemicals of Concern**

None anticipated

Hazard Monitoring / Action Level(s)

None

Response Measures

None

Primary Route(s) of Exposure/Hazard: NA

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. **Additional Safety Equipment/Procedures**

Hard-hat ☐ Yes ☐ No

Safety Glasses ☐ Yes ☐ No

Chemical/splash goggles ☐ Yes ☒ No

Splash Shield ☐ Yes ☒ No

Splash suits/coveralls ☐ Yes ☒ No

Impermeable apron ☐ Yes ☒ No

Steel toe work shoes/boots ☒ Yes ☐ No

High visibility vest ☐ Yes ☐ No

First Aid Kit ☐ Yes ☐ No

Safety Shower/Eyewash ☐ Yes ☐ No

Hearing Protection (Plugs/Muffs) ☐ Yes ☐ No

Safety belt/harness ☐ Yes ☒ No

Radio/Cellular Phone ☐ Yes ☒ No

Barricades ☐ Yes ☒ No

Gloves (Type – Work) ☒ Yes ☐ No

Work/rest regimen ☐ Yes ☒ No

Chemical Resistant Boot Covers ☐ Yes ☐ No

Tape up/use insect repellent ☐ Yes ☐ No

Fire Extinguisher ☐ Yes ☐ No

Other ☐ Yes ☐ No

Modifications/Exceptions: Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET and tape up in such areas. Follow manufacturer's recommendations for proper application and reapplication. Hard hat when overhead hazards exist. Safety glasses when near eye hazards. Hearing protection when in high noise areas.

VIII. **Site Preparation**

Utility Locating and Excavation Clearance completed ☐ Yes ☐ No ☐ NA

Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place ☐ Yes ☐ No ☐ NA

Physical Hazards Identified and Isolated (Splash and containment barriers) ☐ Yes ☐ No ☐ NA

Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc) ☐ Yes ☐ No ☐ NA

IX. **Additional Permits required** (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. **Special instructions, precautions:** Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Review PPE needs based on activities being performed and the associated hazards. Use safe lifting procedures and obtain assistance when handling heavy or awkward objects. Suspend site activities in the event of inclement weather. Observe site workers for signs and symptoms of heat/cold stress. Use sun block (SPF > 15) to prevent sunburn if necessary.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
TEST PIT EXCAVATION AND SAMPLING ACTIVITIES
LOCKHEED MARTIN MSA

Permit No. _____ Date: _____ Time: From _____ to _____

I. Work limited to the following (description, area, equipment used): Test pit excavation and sampling activities – may include confined space entry and step trenching (if necessary)

II. Primary Hazards: Contact with site contaminants; transfer of contamination; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; ambient temperature extremes; insect/animal bites and stings, poisonous plants, inclement weather, heavy equipment and excavation hazards, possible confined space entry

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, or coveralls, safety, glasses and safety footwear. Hard hats and hearing protection will be worn when working near operating equipment.

VI. Chemicals of Concern

Hazard Monitoring /Action Level(s)

Response Measures

VOC's, SVOC's

PID with 10.6 eV
(or greater) probe

>10 ppm above BGL in BZ
no more than 4 exposures of
5 minutes a day

Monitor Breathing zone (BZ) areas
Retreat upwind to unaffected area

Metals

Visual Observation

Visible dust

Employ area wetting methods to
suppress dust generation

Primary Route(s) of Exposure/Hazard: inhalation, dermal, ingestion

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat ☒ Yes ☐ No
Safety Glasses ☒ Yes ☐ No
Chemical/splash goggles ☐ Yes ☒ No
Splash Shield ☐ Yes ☐ No
Splash suits/coveralls ☐ Yes ☐ No
Impermeable apron ☐ Yes ☒ No
Steel toe work shoes/boots ☒ Yes ☐ No
High visibility vest ☐ Yes ☐ No
First Aid Kit ☐ Yes ☐ No
Safety Shower/Eyewash ☐ Yes ☐ No

Hearing Protection (Plugs/Muffs) ☒ Yes ☐ No
Safety belt/harness/lifeline ☒ Yes ☒ No
Radio/Cellular Phone ☐ Yes ☒ No
Barricades ☐ Yes ☒ No
Gloves (Type – Work) ☒ Yes ☐ No
Work/rest regimen ☐ Yes ☒ No
Chemical Resistant Boot Covers ☐ Yes ☐ No
Tape up/use insect repellent ☐ Yes ☐ No
Fire Extinguisher ☐ Yes ☐ No
Other ☐ Yes ☐ No

Modifications/Exceptions: Minimum requirement include sleeved shirt and long pants, safety footwear, and nitrile gloves Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET and tape up in such areas. Follow manufacturer's recommendations for proper application and reapplication. Complete Heavy Equipment Inspection Checklist must be completed prior to work beginning. An Excavation Competent Person must be specifically identified to handle this responsibility prior to work beginning in the specified space provided (Section 1.3) in this HASP. Detailed Excavation Safety Procedures and the Excavation Competent Person Checklist and Heavy Equipment Inspection Checklist are included in Attachments IV, V, and VI and must be completed prior to beginning work. The OSHA Health and Safety Construction-Related regulations P-650 to 699 – Subpart P – Excavations are included in Attachment VII and must be followed during all excavation work. See Section 5 of the HASP for further details. If confined space entry is necessary, review the Tetra Tech Confined Space Entry Program and Procedures in Attachment VIII and complete the Confined Space Checklist in Attachment VIII prior to beginning work.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated (Splash and containment barriers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No
If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Preview work locations to identify potential hazards (slips, trips, and falls, natural hazards, etc.) Review PPE needs based on activities being performed and the associated hazards. Use safe lifting procedures and obtain assistance when handling heavy or awkward objects. Suspend site activities in the event of inclement weather. Observe site workers for signs and symptoms of heat/cold stress. Use sun block (SPF > 15) to prevent sunburn if necessary.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
SOIL BORING MONITORING WELL INSTALLATION
CPT/MP INVESTIGATION
LOCKHEED MARTIN AT MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

Permit No. _____ Date: _____ Time: From _____ to _____

I. Work limited to the following (description, area, equipment used): Soil Boring and Monitoring well installation via DPT Drill Rigs. This task includes MIP/CPT Investigation and sampling soil sampling will occur concurrently with these operations. Also includes concrete coring.

II. Primary Hazards: Contact with contaminated soil or groundwater; transfer of contamination; heavy equipment hazards; noise exposures; contact with energized systems/utilities; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; insect/animal bites and stings, , inclement weather

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. Protective equipment required

Level D ☒ Level B ☐

Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse

No ☒

Modifications/Exceptions: _____

VI. Chemicals of Concern

VOC's, SVOC's

Hazard Monitoring /Action Level(s)

PID with 10.6 eV
(or greater) probe

>10 ppm above BGL in BZ
no more than 4 exposures of
5 minutes a day

Response Measures

Monitor Breathing zone (BZ) areas
Retreat upwind to unaffected area

Metals

Visual Observation

Visible dust

Employ area wetting methods to
suppress dust generation

Primary Route(s) of Exposure/Hazard: Airborne concentrations of VOCs will be monitored through the use of the PID to prevent exposures via inhalation. Incidental ingestion and contact with contaminants will be prevented through the use of PPE and safe work practices. Exposure symptoms can include irritation of eyes, skin, mucous membranes, dizziness, nausea, blurred vision, or narcotic effects,

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat ☒ Yes ☐ No

Safety Glasses ☒ Yes ☐ No

Chemical/splash goggles ☐ Yes ☒ No

Splash shield ☐ Yes ☒ No

Splash suits/coveralls ☐ Yes ☐ No

Impermeable apron ☐ Yes ☒ No

Steel toe work shoes/boots ☒ Yes ☐ No

High visibility vest ☐ Yes ☐ No

First Aid Kit ☐ Yes ☐ No

Safety Shower/Eyewash ☐ Yes ☒ No

Hearing Protection (Plugs/Muffs) ☒ Yes ☐ No

Safety belt/harness ☐ Yes ☒ No

Radio/Cellular Phone ☐ Yes ☐ No

Barricades ☐ Yes ☐ No

Gloves (Type – nitrile/work) ☒ Yes ☐ No

Work/rest regimen ☐ Yes ☐ No

Chemical resistant boot covers ☐ Yes ☐ No

Tape up/use insect repellent ☐ Yes ☐ No

Fire extinguisher ☐ Yes ☐ No

Other ☐ Yes ☐ No

Modifications/Exceptions: Coveralls if the potential for soiling work clothing exists. Other PPE may be specified by the SSO based on conditions (rain gear, rubber boots, etc.), cut resistant gloves during soil sampling, reflective vests in thigh traffic areas.

VIII. Site Preparation

Utility Locating and Excavation Clearance completed ☐ Yes ☐ No ☐ NA

Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place ☐ Yes ☐ No ☐ NA

Physical Hazards Identified and Isolated (Splash and containment barriers) ☐ Yes ☐ No ☐ NA

Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc.) ☐ Yes ☐ No ☐ NA

IX. Additional Permits required (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No

If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090 (Excavation Permit is Required)

X. Special instructions, precautions: Use safe lifting/carrying techniques. Inspect equipment prior to use. Ensure emergency stop devices are functional and initially and then at least weekly thereafter. Minimize contact with potentially contaminated media. Tape up and use insect repellants in high grass or brush areas.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
MONITORING WELL DEVELOPMENT AND MULTIMEDIA SAMPLING
LOCKHEED MARTIN AT MARTIN STATE AIRPORT
MIDDLE RIVER, MARYLAND

Permit No. _____ Date: _____ Time: From _____ to _____

- I. **Work limited to the following (description, area, equipment used):** Monitoring well development, surface, sediment, and groundwater sampling, synoptic water levels and aquifer pump testing are part of this task.
- II. **Primary Hazards:** Contact with site contaminants; transfer of contamination; heavy lifting; slip, trip and fall; ambient temperature extremes; insect/animal bites and stings, inclement weather.
- III. **Field Crew:** _____
- IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐

Respiratory equipment required

Yes ☐ Specify on the reverse
No ☒

Modifications/Exceptions: _____

VI. Chemicals of Concern

VOC's, SVOC's

Metals

Hazard Monitoring /Action Level(s)

PID with 10.6 eV
(or greater) probe
Visual Observation

>10 ppm above BGL in BZ
no more than 4 exposures of
5 minutes a day
Visible dust

Response Measures

Monitor Breathing zone (BZ) areas
Retreat upwind to unaffected area
Employ area wetting methods to
suppress dust generation

Primary Route(s) of Exposure/Hazard: Airborne concentrations of VOCs will be monitored through the use of the PID to prevent exposures via inhalation. Incidental ingestion and contact with contaminants will be prevented through the use of PPE and safe work practices. Exposure symptoms can include irritation of eyes, skin, mucous membranes, dizziness, nausea, blurred vision, or narcotic effects

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-hat ☐ Yes ☒ No
Safety Glasses ☒ Yes ☐ No
Chemical/Splash Goggles ☐ Yes ☒ No
Splash Shield ☐ Yes ☒ No
Splash Suits/Coveralls ☐ Yes ☒ No
Impermeable Apron ☐ Yes ☒ No
Steel Toe Work Shoes or Boots. ☒ Yes ☐ No
High Visibility Vest ☐ Yes ☐ No
First Aid Kit ☐ Yes ☐ No
Safety Shower/Eyewash ☐ Yes ☐ No

Hearing Protection (Plugs/Muffs) ☐ Yes ☒ No
Safety Belt/Harness ☐ Yes ☒ No
Radio/Cellular Phone ☐ Yes ☐ No
Barricades ☐ Yes ☐ No
Gloves (Type – Nitrile) ☒ Yes ☐ No
Work/rest regimen ☐ Yes ☒ No
Chemical Resistant Boot Covers ☐ Yes ☐ No
Tape/Insect Repellent ☐ Yes ☐ No
Fire Extinguisher ☐ Yes ☐ No
Other ☐ Yes ☐ No

Modifications/Exceptions: Boot covers may be specified if work area is muddy. Reflective vests may be required if working near or high traffic areas.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated (Splash and containment barriers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- IX. **Additional Permits required** (Hot work, confined space entry, excavation etc.)..... ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

- X. **Special instructions, precautions:** Use safe lifting/carrying techniques. Inspect equipment prior to use. Minimize contact with potentially contaminated media. Tape up and use insect repellants in high grass or brush areas.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
LAND, EM GEOPHYSICAL WETLAND SURVEYING
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND

Permit No. _____ Date: _____ Time: From _____ to _____

I. **Work limited to the following (description, area, equipment used):** Surveying activities both geophysical, geographical and wetland.

II. **Primary Hazards:** Potential hazards associated with this task: slip, trip and fall; vehicular and foot traffic; temperature extremes; inclement weather; insect /animal bites or stings, poisonous plants, etc.

III. **Field Crew:** _____

IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. **Protective equipment required**

Level D ☒ Level B ☐

Level C ☐ Level A ☐

Modifications/Exceptions: _____

Respiratory equipment required

Yes ☐ Specify on the reverse

No ☒

VI. **Chemicals of Concern**

None expected during this task

Hazard Monitoring

NA

Action Level(s)

NA

Response Measures

NA

Primary Route(s) of Exposure/Hazard: _____

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. **Additional Safety Equipment/Procedures**

Hard-hat ☐ Yes ☒ No

Safety Glasses ☐ Yes ☐ No

Chemical/splash goggles ☐ Yes ☒ No

Splash Shield ☐ Yes ☒ No

Splash suits/coveralls ☐ Yes ☐ No

Impermeable apron ☐ Yes ☒ No

Steel toe work shoes or boots ☒ Yes ☐ No

High Visibility vest ☐ Yes ☐ No

First Aid Kit ☐ Yes ☐ No

Safety Shower/Eyewash ☐ Yes ☒ No

Hearing Protection (Plugs/Muffs) ☐ Yes ☒ No

Safety belt/harness ☐ Yes ☒ No

Radio/Cellular Phone ☐ Yes ☐ No

Barricades ☐ Yes ☒ No

Gloves (Type – Work) ☐ Yes ☐ No

Work/rest regimen ☐ Yes ☐ No

Chemical Resistant Boot Covers ☐ Yes ☒ No

Tape up/use insect repellent ☐ Yes ☐ No

Fire Extinguisher ☐ Yes ☒ No

Other ☐ Yes ☐ No

Modifications/Exceptions: Tape up, use insect repellents. Follow manufacturer's label directions for application and re-application of these products. Wear snake chaps in any high grass or brush areas. Wetland Survey use hip waders and a ranging pole.

VIII. **Site Preparation**

Utility Locating and Excavation Clearance completed ☐ Yes ☐ No ☐ NA

Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place ☐ Yes ☐ No ☐ NA

Physical Hazards Identified and Isolated (Splash and containment barriers) ☐ Yes ☐ No ☐ NA

Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc) ☐ Yes ☐ No ☐ NA

IX. **Additional Permits required** (Hot work, confined space entry, excavation etc.) ☐ Yes ☒ No

If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. **Special instructions, precautions:** Suspend activities in the event of inclement weather. For wetland surveys conducted in water follow the procedures outlined in Section 5.8 . For the wetland survey follow the procedure outlined in Section 5.4 of this HASP for safe work procedures.

Permit Issued by: _____ Permit Accepted by: _____

SAFE WORK PERMIT
SOIL BORING AND MONITORING/DEEP WELL INSTALLATION
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND
PAGE 1 OF 2

Permit No. _____ Date: _____ Time: From _____ to _____

I. **Work limited to the following (description, area, equipment used):** Soil boring and monitoring well installation. Soil boring will generally be performed using DPT and HSA Rigs, while the monitoring wells will be installed via HSA. This task includes well development and the installation of vapor monitoring points and installation of membrane interface probes. Deep well installation via Rotasonic drill rig from a barge will be part of this activity.

II. **Primary Hazards:** Contact and transfer of site contaminants; heavy equipment hazards; elevated noise; energized systems/utilities; heavy lifting; slip, trip and fall; cuts and lacerations; vehicular and foot traffic; ambient temperature extremes; flying projectiles; insect/animal bites and stings, poisonous plants, inclement weather, drowning.

III. **Field Crew:** _____

IV. **On-site inspection conducted** ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

Equipment inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. **Protective equipment required**

Level D ☒ Level B ☐

Level C ☐ Level A ☐

Modifications/Exceptions: _____

Respiratory equipment required

Yes ☐ Specify on the reverse

No ☒

VI. **Chemicals of Concern**

VOC's, SVOC's

Hazard Monitoring /Action Level(s)

PID with 10.6 eV

(or greater) probe

>10 ppm above BGL in BZ

no more than 4 exposures of

5 minutes a day

Visible dust

Response Measures

Monitor Breathing zone (BZ) areas

Retreat upwind to unaffected area

Metals

Visual Observation

Employ area wetting methods to

suppress dust generation

Dust components may include metals, sand, grout. Encountering airborne concentrations above background levels in the breathing zone (BZ) during this activity is not anticipated based on historical source concentrations. SSO to take and record background levels at least daily.

Primary Route(s) of Exposure/Hazard: Inhalation, ingestion and skin contact. Controls include monitoring instrument use, dust control, use of PPE, and following safe work practices. VOCs – irritating at all points of contact; CNS effects (blurred vision, narcotic effects, dizziness); Extremely high concentrations may result in Irregular heartbeats, possible cardiac arrest. Sand, bentonite, grout may cause mechanical irritation (eyes) as well as potential alkali burns; respiratory, eye, and mucous membrane irritation.

Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. **Additional Safety Equipment/Procedures**

Hard-hat ☒ Yes ☐ No

Safety Glasses ☒ Yes ☐ No

Chemical/splash goggles ☐ Yes ☒ No

Splash shield ☐ Yes ☒ No

Splash suits/coveralls ☐ Yes ☐ No

Impermeable apron ☐ Yes ☒ No

Steel toe work shoes or boots ☒ Yes ☐ No

High visibility vest ☐ Yes ☐ No

First Aid Kit ☐ Yes ☐ No

Safety Shower/Eyewash ☐ Yes ☒ No

Hearing Protection (Plugs/Muffs) ☒ Yes ☐ No

Safety belt/harness ☐ Yes ☒ No

Radio/Cellular Phone ☐ Yes ☐ No

Barricades ☐ Yes ☐ No

Gloves (Type – nitrile/work) ☒ Yes ☐ No

Work/rest regimen ☐ Yes ☐ No

Chemical resistant boot covers ☐ Yes ☐ No

Tape up/use insect repellent ☐ Yes ☐ No

Fire extinguisher ☐ Yes ☐ No

Other ☐ Yes ☐ No

Modifications/Exceptions: Coveralls if the potential for soiling work clothing exists. Other PPE is possible based on conditions (rain gear, rubber boots, etc.)

**SAFE WORK PERMIT
SOIL BORING AND MONITORING/DEEP WELL INSTALLATION
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND
PAGE 2 OF 2**

VIII. Site Preparation	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated (Splash and containment barriers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IX. Additional Permits required (Hot work, confined space entry, excavation etc.)..... ☒ Yes ☐ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090 (Excavation Permit is Required)

X. Special instructions, precautions: Use safe lifting/carrying techniques. Inspect equipment prior to use. Ensure emergency stop devices are functional and test daily. Minimize contact with potentially contaminated media and assume soils/groundwater are contaminated. Use waterless hand cleaner products or disinfecting wipes on boat after sampling until access to proper hands washing facilities on shore can be reached. Heavy Equipment Inspection Checklist must be completed prior to beginning work.

Permit Issued by:_____ Permit Accepted by:_____

**SAFE WORK PERMIT
IDW MANAGEMENT
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND**

Permit No. _____ Date: _____ Time: From _____ to _____

SECTION I: General Job Scope

- I. **Work limited to the following (description, area, equipment used):** IDW management activities includes containerization, staging, monitoring for leaks of IDW accumulated wastes. Wastes types include soil cutting, purge and decontamination wash waters.
- II. **Primary Hazards:** Lifting, pinches and compressions; flying projectiles; slips, trips, and falls and chemical contamination.
- III. **Field Crew:** _____
- IV. **On-site Inspection conducted** ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☒ No Initials of Inspector _____ Tetra Tech

SECTION II: General Safety Requirements (To be filled in by permit issuer)

- V. **Protective equipment required** **Respiratory equipment required**
Level D ☒ Level B ☐ Yes ☐ See Reverse
Level C ☐ Level A ☐ No ☒
Modifications/Exceptions: None anticipated

VI. Chemicals of Concern <u>None anticipated</u>	Hazard Monitoring /Action Level(s) <u>N/A</u>	Response Measures <u>N/A</u>
--	---	--

Primary Route of Exposure/Hazard: inhalation, dermal, ingestion

(Note to FOL and/or SHSO: Each item in Sections VII, VIII, and IX must be checked Yes or No)

VII. Additional Safety Equipment/Procedures

Hard-hat <input type="checkbox"/> Yes <input type="checkbox"/> No Safety Glasses <input type="checkbox"/> Yes <input type="checkbox"/> No Chemical/splash goggles <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Splash Shield <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Splash suits/coveralls <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Impermeable apron <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Steel toe work shoes/boots <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No High visibility vest <input type="checkbox"/> Yes <input type="checkbox"/> No First Aid Kit <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Safety Shower/Eyewash <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Hearing Protection (Plugs/Muffs) ... <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Safety belt/harness <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Radio/Cellular Phone <input type="checkbox"/> Yes <input type="checkbox"/> No Barricades <input type="checkbox"/> Yes <input type="checkbox"/> No Gloves (Type – Leather/Cotton) <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Work/rest regimen <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Chemical Resistant Boot Covers <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Tape up/use insect repellent <input type="checkbox"/> Yes <input type="checkbox"/> No Fire Extinguisher <input type="checkbox"/> Yes <input type="checkbox"/> No Other <input type="checkbox"/> Yes <input type="checkbox"/> No
--	---

Modifications/Exceptions: If using pneumatic/electric power to open drums – Safety glasses are required. If power equipment is used to move drums or you are working near operating equipment hard hats will be worn. Tyvek coverall to protect against natural hazards (e.g., ticks) if working/walking through areas of high grass. Use insect repellants containing at least 10% DEET if necessary. Follow manufacturer's recommendations for proper application and reapplication. If working in areas where snakes are a threat, wear snake chaps to protect against bites. High visibility vest if near active traffic areas.

VIII. Site Preparation	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IX. Additional Permits required (Hot work, confined space entry, excavation etc.)..... <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			
<i>If yes, SHSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090</i>			

- X. **Special instructions, precautions:** Suspend site activities in the event of inclement weather. Employ proper lifting techniques. When/where possible use heavy equipment to move and place containers. When placing drums – Place the label and retention ring nut on the outside where it is readily visible. Place 4-drums to a pallet. Maintain a minimum distance of 4-feet between pallet rows. An IDW inventory shall be generated to provide the number of drums, contents, and volumes. This inventory should be provided to the facility contact. Inspect equipment prior to use.

Permit Issued by: _____ Permit Accepted by: _____

**SAFE WORK PERMIT
DECONTAMINATION ACTIVITIES
LOCKHEED MARTIN MSA
MIDDLE RIVER, MARYLAND**

Permit No. _____ Date: _____ Time: From _____ to _____

I. Work limited to the following (description, area, equipment used): Decontamination of Split Spoons, MacroCore Samplers (or similar equipment) DPT drive rods, associated heavy equipment and CPT/MIB Probes and equipment. Personal decon activities. Decontamination of heavy equipment and machinery with pressure washers and/or steam cleaning units. This will be accomplished at a constructed temporary decontamination pad at the work site.

II. Primary Hazards: Contact with site contaminants; decon fluids; elevated noise; heavy lifting; slip, trip and fall; cuts; flying projectiles; inclement weather

III. Field Crew: _____

IV. On-site Inspection conducted ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech
Equipment Inspection required ☐ Yes ☐ No Initials of Inspector _____ Tetra Tech

V. Protective equipment required

Level D ☒ Level B ☐
Level C ☐ Level A ☐

Modifications/Exceptions: _____

Respiratory equipment required

Yes ☐ Specify on the reverse
No ☒

VI. Chemicals of Concern	Hazard Monitoring	Action Level(s)	Response Measures
Volatile Organics Compounds (VOCs)	PID	Any detection above bkgd	Repeat decontamination procedure
Liquinox (soap)	None Required	None	Eye irritant/flush with clean water

Primary Route(s) of Exposure/Hazard: _____ During this activity the primary concern is contact and potential absorption.
Soap – Contact - eye/skin/mucous membrane irritation upon direct contact...

(Note to FOL and/or SSO: Each item in Sections VII, VIII, and IX must be checked Yes, No, or NA)

VII. Additional Safety Equipment/Procedures

Hard-Hat	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Hearing Protection (Plugs/Muffs)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Safety Glasses	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Safety Belt/Harness	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Chemical/Splash Goggles	<input type="checkbox"/> Yes <input type="checkbox"/> No	Radio/Cellular Phone	<input type="checkbox"/> Yes <input type="checkbox"/> No
Splash Shield	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Barricades	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Splash Suits/Coveralls	<input type="checkbox"/> Yes <input type="checkbox"/> No	Gloves (Type – Nitrile)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Impermeable apron	<input type="checkbox"/> Yes <input type="checkbox"/> No	Work/rest Regimen	<input type="checkbox"/> Yes <input type="checkbox"/> No
Steel Toe Work Shoes or Boots	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Chemical Resistant Boot Covers	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
High Visibility Vest	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Tape/Insect Repellent	<input type="checkbox"/> Yes <input type="checkbox"/> No
First Aid Kit	<input type="checkbox"/> Yes <input type="checkbox"/> No	Fire Extinguisher	<input type="checkbox"/> Yes <input type="checkbox"/> No
Safety Shower/Eyewash	<input type="checkbox"/> Yes <input type="checkbox"/> No	Other	<input type="checkbox"/> Yes <input type="checkbox"/> No

Modifications/Exceptions: Impermeable aprons may be used to control splashing/overspray. If this is inadequate replace with rainsuit or PE coated Tyvek. Hard hat, splash shield, and hearing protection will be worn when working near operating equipment or during pressure washer/steam cleaner operation. Gloves – Nitrile (surgeons style) or nitrile type outer gloves for deconning associated sampling equipment. Overboots will be used when working in the temporary decontamination pad.

VIII. Site Preparation

	Yes	No	NA
Utility Locating and Excavation Clearance completed	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vehicle and Foot Traffic Routes Established/Traffic Control Barricades/Signs in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Physical Hazards Identified and Isolated (Splash and containment barriers)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Emergency Equipment Staged (Spill control, fire extinguishers, first aid kits, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IX. Additional Permits required (Hot work, confined space entry, excavation etc.)..... ☐ Yes ☒ No
If yes, SSO to complete or contact Health Sciences, Pittsburgh Office (412)921-7090

X. Special instructions, precautions: Suspend site activities in the event of inclement weather (storms, high winds, etc.). In addition, do NOT point the Pressure washer wand at other people or place it against any part of your body. Accidental compression of the trigger can cause serious lacerations or burns. All hoses and fittings will be inspected to ensure structural integrity prior to use. For pressure washers or steam cleaners in excess of 3,000 psi, a fan tip of 25° or greater will be used to control potential for water cuts or lacerations. A light coating of sand should be applied to the plastic liner should the surface becomes too slippery to prevent slips. Keep hoses gathered to prevent trips and falls. A site control boundary for this activity is 25-feet surrounding the point of operation. Follow directions provided in the MSDSs for any decontamination solvents/solutions used in the decontamination procedure.

Permit Issued by: _____ Permit Accepted by: _____

ATTACHMENT V
EQUIPMENT INSPECTION CHECKLIST
FOR DRILL/DPT RIGS

Equipment Inspection Checklist for Drill/DPT Rigs

Company: _____

Unit/Serial No#: _____

Inspection Date: ____ / ____ / ____ Time: ____ :

Equipment Type: _____
(e.g., Drill Rigs Hollow Stem, Mud Rotary, Direct Push, HDD)

Project Name: _____

Project No#: _____

Yes	No	NA	Requirement	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Emergency Stop Devices	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Emergency Stop Devices (At points of operation) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Have all emergency shut offs identified been communicated to the field crew? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Has a person been designated as the Emergency Stop Device Operator? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Highway Use	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Cab, mirrors, safety glass? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Seat Belts? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Is the equipment equipped with audible back-up alarms and back-up lights? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Horn and gauges 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Brake condition (dynamic, park, etc.) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Tires (Tread) or tracks 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Windshield wipers 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Exhaust system 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Steering (standard and emergency) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Wheel Chocks? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Are tools and material secured to prevent movement during transport? Especially those within the cab? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Are there flammables or solvents or other prohibited substances stored within the cab? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Are tools or debris in the cab that may adversely influence operation of the vehicle (in and around brakes, clutch, gas pedals) 	

Equipment Inspection Checklist for Drill Rigs

Page 2

Unit/Serial No#: _____

Inspection Date: ____ / ____ / ____

Yes	No	NA	Requirement	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Fluid Levels: <ul style="list-style-type: none"> • Engine oil • Transmission fluid • Brake fluid • Cooling system fluid • Hoses and belts • Hydraulic oil 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	High Pressure Hydraulic Lines <ul style="list-style-type: none"> • Obvious damage • Operator protected from accidental release • Coupling devices, connectors, retention cables/pins are in good condition and in place 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Mast Condition <ul style="list-style-type: none"> • Structural components/tubing • Connection points • Pins • Welds • Outriggers • Operational • Plumb (when raised) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hooks <ul style="list-style-type: none"> • Are the hooks equipped with Safety Latches? • Does it appear that the hook is showing signs of wear in excess of 10% original dimension? • Is there a bend or twist exceeding 10% from the plane of an unbent hook? • Increase in throat opening exceeding 15% from new condition • Excessive nicks and/or gouges • Clips • Number of U-Type (Crosby) Clips (cable size 5/16 – 5/8 = 3 clips minimum) (cable size 3/4 – 1 inch = 4 clips minimum) (cable size 1 1/8 – 1 3/8 inch = 5 clips minimum) 	

Equipment Inspection Checklist for Drill Rigs

Page 3

Unit/Serial No#: _____

Inspection Date: ____/____/____

Yes	No	NA	Requirement	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Power cable and/or hoist cable <ul style="list-style-type: none"> Reduction in Rope diameter π (5/16 wire rope > 1/64 reduction nominal size -replace) (3/8 to 1/2 wire rope > 1/32 reduction nominal size-replace) (9/16 to 3/4 wire rope > 3/64 reduction nominal size-replace) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Number of broken wires (6 randomly broken wires in one rope lay) (3 broken wires in one strand) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Number of wire rope wraps left on the Running Drum at nominal use (≥ 3 required) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Lead (primary) sheave is centered on the running drum	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Lubrication of wire rope (adequate?) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Kinks, bends – Flattened to > 50% diameter 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Hemp/Fiber rope (Cathead/Split Spoon Hammer) <ul style="list-style-type: none"> Minimum $\frac{3}{4}$; maximum 1 inch rope diameter (Inspect for physical damage) 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Rope to hammer is securely fastened 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Safety Guards – <ul style="list-style-type: none"> Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Hot pipes and surfaces exposed to accidental contact? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> High pressure lines 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Nip/pinch points 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Operator Qualifications <ul style="list-style-type: none"> Does the operator have proper licensing where applicable, (e.g., CDL)? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Does the operator, understand the equipment's operating instructions? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Is the operator experienced with this equipment? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Is the operator 21 years of age or more? 	

Equipment Inspection Checklist for Drill Rigs

Page 4

Unit/Serial No#: _____

Inspection Date: ____/____/____

Yes	No	NA	Requirement	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PPE Required for Drill Rig Exclusion Zone	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Hardhat	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Safety glasses	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Work gloves	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical resistant gloves _____	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Steel toed Work Boots	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical resistant Boot Covers	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Apron	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Coveralls Tyvek, Saranex, cotton) _____	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other Hazards	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Excessive Noise Levels? _____ dBA	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- MSDSs available?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Will On-site fueling occur	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Safety cans available?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Fire extinguisher (Type/Rating - _____)	

Approved for Use ☐ Yes ☐ No ☐ See Comments

Site Health and Safety Officer

Operator

ATTACHMENT VI

EXCAVATION SAFETY PROCEDURES

EXCAVATION SAFETY

INTRODUCTION

Tetra Tech NUS (TtNUS) site activities often require field crews to work in and/or around subsurface investigation, excavation and trenching activities. In this module we will provide information on the procedures and protocols involved in and around these types of subsurface investigations, excavations and trenching activities.

The elements of this presentation provide an overview of the responsibilities and hazards of these types of operations. The elements of this presentation are not intended to meet the OSHA requirements for Employer Designated “Competent Person” for Excavation Safety.

The information will be presented in a logical progression as would be encountered at a typical TtNUS field job. The information is structured to demonstrate how initial actions will build upon successive actions to culminate into a safe excavation. In addition the information is intended to provide minimal requirements that would be included in an Excavation Protection Program.

The text presented in this module will cover the following subject matter:

- Key Personnel-Roles and Responsibilities
- Utility Locating and Excavation Clearance
- Equipment Inspections
- Documentation
- Emergency Response for Utilities
- Site Control
- Surface Encumbrances
- Visual Analysis
- Manual Tests
- Protective Systems
- Hazardous Atmospheres
- Emergency Rescue Equipment and Provisions
- Periodic Inspections

REGULATORY DEFINITIONS

"Accepted engineering practices" means those requirements which are compatible with standards of practice required by a registered professional engineer.

"Aluminum Hydraulic Shoring" means a pre-engineering shoring system comprised of aluminum hydraulic cylinders (cross braces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the side walls of an excavation and prevent cave-ins.

"Bell-bottom pier hole" means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

"Benching (Benching system)" means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

"Cave-in" means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or other wise injure and immobilize a person.

"Competent person" means one who 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.

"Cross braces" mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

"Excavation" means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

"Faces" or **"sides"** means the vertical or inclined earth surfaces formed as a result of excavation work.

"Failure" means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

"Hazardous atmosphere" means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

"Kick out" means the accidental release or failure of a cross brace.

"Protective system" means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

"Ramp" means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

"Registered Professional Engineer" means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

"Sheeting" means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

"Shield (Shield system)" means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

"Shoring (Shoring system)" means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

"Sides". See "Faces."

"Sloping (Sloping system)" means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with

differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

"Stable rock" means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

"Structural ramp" means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

"Support system" means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

"Tabulated data" means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

"Trench (Trench excavation)" means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (Measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

"Trench box." See "Shield."

"Trench shield." See "Shield."

"Uprights" means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

"Wales" means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

KEY PERSONNEL ROLES AND RESPONSIBILITIES

As with any OSHA performance based standard, certain personnel are identified as key personnel. Those persons responsible for the implementation of the standard's elements and safety practices to ensure a safe excavation. These persons will be primarily responsible for safely completing project objectives. The following are assigned primary responsibility for excavation safety.

- Employer Designated "Competent Person"
- Registered Professional Engineer
- Employees

The roles and responsibilities of these individuals are explained in further detail below.

Employer Designated "Competent Person"

The Employer Designated "Competent Person" is responsible for all aspects of excavation safety. This includes:

Pre-Excavation Activities

- Utility Clearance identification and marking
- Establishment of site control measures (temporary utilities, temporary traffic patterns, barricades, signs, etc.)
- Removal and/or control of Surface and Subsurface Encumbrances
- Traffic (Foot/Vehicular) Impact and routing
- Surface drainage patterns and impact

During Excavation Activities

- Utility sweeps
- Review and evaluation of entry/egress systems
- Installing support systems for surface and subsurface encumbrances as necessary. (i.e. supporting building foundations, sidewalks, utility runs, etc.)
- Soil classification – Visual and Manual Analysis
- Hazardous atmosphere evaluation (initial and periodic monitoring)

- Recommendation/Installation/Evaluation of protective system (in and out of the excavation)

Post Excavation Activities

- Evaluation of the protective systems installed (sloping, benching, shielding, etc.)
- Soil conditions (Moisture content, fissures developing, horizontal cracks, etc.)
- Loading the excavation walls (Spoils piles, resource/fill materials stock piling, traffic, etc.)
- Atmospheric monitoring
- Back-fill

Competent Persons Qualifications

- The employer designates Competent Person(s) based on knowledge and training.
- Capable of identifying existing or predictable hazards associated with excavated cuts or cavities in the earth.
- Has the authority to take prompt action to abate these hazards.
- Working knowledge of Soil Analysis/Soil Classification.
- Knowledgeable in the area of Protective Systems.
- Working knowledge of the requirements of 29 CFR 1926 Subpart P.

This position will typically be filled by Site Safety Officer (SSO), Field Operations Leader (FOL), or a Registered Professional Engineer. **It has to be a person specifically identified by the employer to handle this responsibility in the Site Specific HASP.**

Registered Professional Engineer

The Registered Professional Engineer whose qualifications are based on the type of work being conducted. In other words you can't be a Registered "Electrical" Engineer designing mechanical systems. The Engineer is responsible for the:

- Design of excavation specifications. This is especially true when the excavation is expected to be in excess of 20 feet.
- Design of protective systems.

- Design of access and egress systems to be used when entering or exiting excavations and trenches.

NOTE: The Engineer may serve as the "Competent Person" providing they have been designated by the Employer and meet all of the specific qualifications.

Employee

The employee has a primary responsibility to perform the work as outlined in the scope of work for the project. The employee must be cognizant of potential hazards and response measures to those hazards. The primary roles and responsibilities of the employee are to:

- Follow the instructions provided by the Designated Competent Person.
- Follow the provisions of the Safe Work Permit issued for that excavation or work activity.
- Follow the directions provided in the Health and Safety Plan (HASP).
- When a hazard is identified take evasive measures. **When hazards are recognized report them to the Competent Person, immediately!**

Once the field crew has been assembled the next item to be accomplished is site preparation for the excavation.

SITE PREPARATION

Prior to the commencement of excavation, the following measures must be taken for:

- Utility clearance
- Site control
- Site preparation will be undertaken in support of a safe excavation, trenching, or subsurface investigation.

Utility locating and Excavation Clearance

The Standard Operating Procedure (SOP) "Utility Locating and Excavation Clearance" (HS-01) is on the TtNUS Intranet Web site and must accompany the site-specific HASP. This company wide policy provides for the identification, marking, and non-invasive techniques used to identify and locate utilities.

When subsurface activities are identified in the scope of work whether it be excavation, trenching, or drilling, initial preparation must include utility locating and clearance. To accomplish the Utility Locating and Clearance the following items will be completed.

1. All excavation boundaries or subsurface boring locations will be identified in white paint and/or flagging. White is the preferred color as utility services generally use the following identification colors:
 - Orange – Communications/Cable TV
 - Green – Sewage
 - Blue – Water
 - Red – Electrical
 - Yellow - Gas/Oil/Steam
 - Pink – Temporary Survey Markings

Identification of the excavation or subsurface investigation point will provide Host or Subcontractor Utility Clearance services positive identification of points of interest. When possible provide drawings, maps, etc. to the locating service when submitting your ticket.

2. Perform a records search where possible (i.e., public works on military installations, municipal zoning offices and building inspection offices, historical archives, etc.). The information that needs to be obtained are building plans, approach routes of utility support services.
3. Walk over the ground to be excavated and/or drilled and look for surface monuments (i.e., manhole covers, line of sight and depth of piping leaving the manhole or other physical structure, telephone or cable boxes indicating travel direction of piping, underground wiring, fire hydrants, water meters and valves, etc.)
4. Commercial Utility Locating Services are available in most areas of the country. They will request information on the area where the service is required such as:
 - Building addresses.
 - Street intersections/street runs.
 - Detailed drawings as to the location of the subsurface investigation point or excavation. This along with the markings in white paint on the ground will provide the necessary detail to your utility locating and clearance service.

The following information and request will need to be provided to the utility locating and clearance service (at Least 48 Hours Before You Intend to Dig, some services require 5 working days notification):

- a) Company Name & Address
- b) Contact Person's Name & Phone Number
- c) Call Back Hours
- d) Dig Site location County & City
- e) Location Address
- f) Nearest Cross Street
- g) Machinery To Be Used
- h) Permit Needed
- i) Work Done For
- j) Type of Work

5. Even though another company or our own client contact may provide detection methods, it is still our responsibility to use limited safety invasive techniques during the excavation activity. These techniques include:

- Fiberglass soil probes
- Shovels
- Magnetic pipe and cable locators
- Electromagnetic detectors
- Ground Penetrating Radar

These devices provide some up-front warning as the excavation approaches buried objects, which may have not been detected during the clearance procedure.

DIG only when you have approval from the client contact and/or the utility locating company. In some cases utility clearances cannot be obtained. In these cases the TOM or PM may direct you to proceed. Utilize the procedures listed above to ensure the area is clear.

EQUIPMENT INSPECTIONS

The primary reason for equipment inspections is to ensure hazards potentially caused by faulty equipment are minimized, guarded, and/or removed. Equipment inspections will be conducted on all mechanized equipment at the following frequencies:

- On-site arrival and departure
- Once every 10-Day Shift;
- After major repairs

When performing equipment inspections use the Equipment Inspection Checklists provided in your site-specific HASP or in the TtNUS Health and Safety Guidance Manual.

DOCUMENTATION

Maintain documentation onsite during excavation, trenching, or subsurface investigation activities. This documentation includes:

- The Utility Locating and Excavation Clearance Permit. This permit is provided in the “Utility Locating and Excavation Clearance” SOP and provides a documentation tracking mechanism as well as invasive techniques used to avoid utility contact and/or damage. This will be completed for each excavation when the digging is separated by a significant distance or for each area if many subsurface investigation points are close together.
- A copy of the ticket number and the request must be obtained from the Utility Locating and Clearance provider.
- Host Provided Utility Clearance - Many client installations provide utility clearance services. The FOL will be required to determine what services are provided by the client and the procedure for acquiring a private contractor. Note: In many instances the client may only provide service for gas, water, electric and sewage. A private contractor may need to be obtained for telephone, cable TV, and fiber optics.
- Equipment Inspection Checklist – Fill out the equipment inspection checklists provided in the HASP.
- The following items are identified in the HASP and are required to be maintained on-site:
 - Copy of the HASP and Guidance Manual
 - Training/Medical Qualifications
 - Logbook, etc.

STATE REQUIREMENTS TO PREVENT UTILITY DAMAGE

Each individual state (i.e., Pennsylvania, Louisiana, Minnesota) have their own procedures for the prevention of utility damage during subsurface activities. Within these documents (which are different for each state) provisions to guard against utility damage such as, but not limited to

- Provisional requirements for the use of mechanical vs. hand progression. For example, Florida requires 4 feet hand progression for all isolated points. Some states may require progression by hand when within a predetermined proximity to a utility. Pennsylvania and Louisiana for example require that when you are digging within 18 inches plus the diameter of the utility of a utility location, you must proceed by hand until you have passed the utility. Louisiana requires when you are digging within 18 inches plus the width of the utility, you must proceed by hand.
- All states define how close you can dig by mechanized means and what that distance is based on.
- All states have procedures in place for utility clearances and civil penalties for those who circumvent these procedures.
- Facility Requirements – Remember to inquire regarding additional facility-specific requirements, and follow them closely.

When there is significant potential to damage utilities due to the proximity, number of boreholes, or subsidence caused by under digging, consideration must be given to the repair of utilities in the event they are damaged. The cost associated with utility damage may not only include repairs but also the interruption of service. Costs are set on a time frame (per/hour basis) making rapid repair critical in damage control to our company and our client's assets.

To support rapid response, when possible secure utility damage response teams. If it is a facility provided function have emergency numbers and contacts readily available.

SITE CONTROL

Prior to the start of excavation, trenching or subsurface investigation activity efforts should be directed to control external influences that negatively influence the health and safety of site personnel and the general public. One way is to control the entry of unauthorized personnel through site control and establishment of work zones (exclusion, contamination reduction, and support zones).

Exclusion Zone

The excavation (exclusion zone) area is constructed to prevent and supervise the control of unauthorized personnel from approaching within a specified distance of our excavation. This zone serves as the point where TtNUS and subcontractor personnel will take precautions identified within the HASP and/or the SWP. The exclusion zone is an area of active operation with a predetermined boundary necessary to conduct site operations. This boundary is based on several factors:

- 1) Physical and topographical features of the site
- 2) Weather conditions and influence
- 3) Toxic potential and concentrations of the contaminants in the dig.
- 4) Air dispersion assessments.
- 5) Potential for explosion and/or flying debris
- 6) Area required to safely conduct assigned tasks.
- 7) Dimensions of the dig site.
- 8) The exclusion zone may reflect the swing path of the bucket and boom or the height of a mast (Full extended horizontal length) plus a safety zone of five feet to remove persons from physical hazards.

Additional elements of site control include:

- Storage of excavated materials and resources must be located a sufficient distance from the excavation (Two feet or greater unless the wall is supported. This is to prevent items from falling back in to the excavation or overloading the wall strength thus causing a collapse).
- Traffic control mechanisms to prevent heavy, light, and foot traffic from inadvertently approaching and entering the excavation.
- Spotters should be used to direct heavy equipment movement and watch the excavation so back-fill does not injure anyone in the trench. All Spotters and flag persons will wear high visibility vests in order to be seen.

In all cases, the boundaries should be well marked and physically restricted, where necessary.

Demarcation of Boundaries

- Fencing or caution tape should surround the entire exclusion zone when necessary to restrict unauthorized personnel.
- Signs should read “Caution Open Excavation” on a yellow background with black print.
- Excavation security:
 - 1) Remove hazards to the extent possible (Slope sidewalls to prevent overnight collapse, install shielding as necessary).
 - 2) Excavation that is left unattended or open will be secured with a restricting fence and proper signage. In all cases, where it is necessary to leave an excavation open, provisions will be made for persons to exit should they accidentally enter the excavation.

Surface and Subsurface Encumbrances

Surface and subsurface encumbrances are objects within the path or closely associated with the boundaries of an excavation or trench location.

Types of Surface Encumbrances

- Trees
- Boulders
- Sidewalks
- Spoils pile
- Foot/vehicular traffic routes
- Railways
- Surface drainage patterns.

Types of Subsurface Encumbrances

- Building foundations
- Building supports
- Telephone poles
- Underground utilities.

The methods for safely dealing with encumbrances are:

Make it safe - Have a Registered Professional Engineer or a Competent Person evaluate the impact of the surface or near surface encumbrance to determine appropriate measures. These may include

- Shoring up and stabilizing foundations and utilities
- Use a different type of excavation method to proceed in areas impacted by such problems (i.e., horizontal drilling, etc.)
- Move the surface encumbrance away from the edge of the excavation, if it falls over, it will not enter the excavation.
- Install support walls to assist in supporting or holding the surface encumbrance.
- Install surface blockades blocking equipment and other traffic from approaching the excavation to closely.

Remove it - Relocation of the surface or near surface encumbrance. This may include, but not limited to

- Alteration of foot/vehicular traffic to other routes.
- Temporary utility lines to continue service when interruptions may occur.
- Alterations of surface drainage patterns

Additional Methods

We have discussed the steps to take to properly prepare for excavation, trenching, etc. In all subsurface investigations the pace will proceed slowly until the point is passed where utility concerns no longer exist. In less invasive techniques, such as soil probes, a magnetometer are used prior to mechanized advancement avoiding utility damage.

While our general discussion to this point has focused on activities that are considered typical for military reservations, responsibilities for commercial and residential operations may require additional measures such as:

- Excavation Permits – Many municipalities have excavation permits which must be filed and approved.
- Various state, county, and municipalities depending on the nature and size of the excavation may require Stormwater Management Plans

- Building Permits

In these situations always check local requirements including content and timeline as part of your planning effort.

EXCAVATION COMMENCEMENT

The preliminary work is completed; the excavation can get underway. There are several activities, which will be conducted concurrently with the excavation activity. As the excavation proceeds the first step is for the Employer Designated “Competent Person” to begin the evaluation process. This process should determine as much information about the excavation or trenching as possible. This includes:

- Visual Analysis
- Excavation collapse/cave-ins
- Manual tests
- Protective Systems
- Atmospheric hazards qualification/quantifications
- Evaluation of the hazard control measures

Let us look at each one of these more carefully:

Visual Analysis

OSHA requires that at least one visual and one manual test be performed to determine the nature of the soils involved in the excavation. It should be noted that soil characteristics could be determined in many ways. The following are examples that can be performed easily in the field even if you’re not the “Competent Person”. Remember safety is everyone’s responsibility

- Estimation of particle size and percent amount of fines. The intent is to determine the level of plasticity (cohesiveness) or granular composition of the soil.
 - Fine Grain – Tend to be more cohesive
 - Course Grain – Tend to be less cohesive, and therefore moves more easily.

Objective: To determine through visual evaluations conditions associated with the excavation or activities within the immediate vicinity that may impact the safety of the excavations.

- Cohesiveness
 - Generally expressed as to the amount of clay impacting the plasticity and hence cohesive qualities.
 - Soils which remain in clumps are generally considered cohesive, they do not crumble and are plastic consistency when moist
 - These soil types generally include clayey silt (ML/CL), silty clay (CL/ML), sandy clay (SP-CL), clay and organic clay
- Dry granular soils
 - Little to no moisture content
 - Cannot be easily molded when moist, crumbles easily
 - Breaks up easily when excavated is generally more granular
 - These soil types generally include poorly graded gravel (GP), poorly graded gravel with silt (GP-GM)
- Moisture content
 - Too wet? Soils that become too wet increase their mobility due to a reduction in friction and binding properties. In addition soils which become water loaded increase in weight which makes excavation walls prone to collapse under these conditions. Active seeps, surface drainage contributes to this hazard. Therefore, soils associated with this condition are downgraded to Type C soils due to their instability.
 - Too dry - Reduced binding properties and flexibility in the soils

Purpose of Visual Evaluation

The purpose of the visual evaluation are to identify potential problems that would impact the excavation stability. Excavation Walls are particularly prone to the hazards of saturation and drying because of their exposed surfaces. This establishes the basis for periodic inspections. Other conditions associated with excavation wall failure that you should be able to identify visually include:

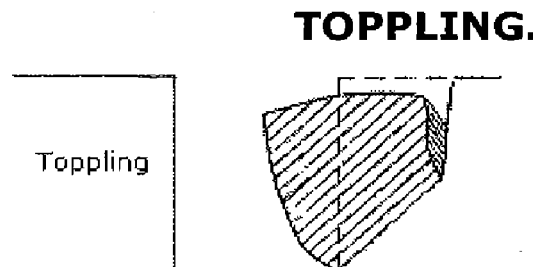
- Fissured – soils breaks along defined planes
- Seeps or other water loading
- Man-made planes due to burial activities, where collapse may occur

Roughly characterizing the soil types and conditions, as well as the surrounding conditions of excavation wall will provide you information on the stability of the cut.

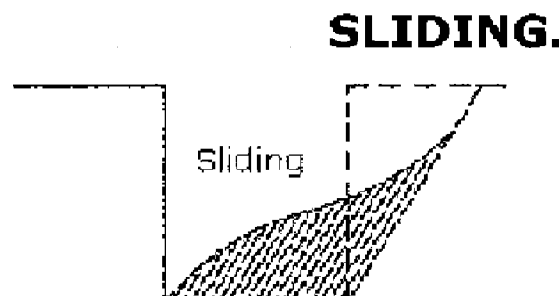
Other Hazard Signs (Visual Evaluation Continued)

Look for cracks along the surface areas adjacent to the excavations. This is usually indicative of tension cracks, cracks that have a horizontal distance of 0.5 to 0.75 times the depth of the trench, will predispose the wall of the excavation to the following conditions:

- Toppling – The wall pulls away due to the fact it is top heavy possibly due to some undercutting by the excavator.



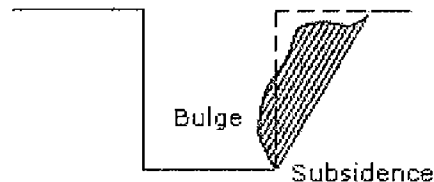
- Sluffing/Sliding into the excavation. This type of excavation failure will be more likely if there is a greater degree of bulging near the bottom of the cut. This is also referred to as subsidence or bulging. Generally this condition results from overloading walls with spoil piles and resources, or brought on by heavy traffic. Look for cracks, fissures, and soil spalls relieved from the sides of the excavations.



- Bulging of the sides or bottoms. This results in a condition called heaving or boiling. Heaving is caused by the weight of the adjoining soils downward pressure that causes an upward pressure in the side or bottom of the cut. More

predominantly seen when shoring or shielding is used to control surface encumbrances.

SUBSIDENCE AND BULGING.



- Seeping water/surface drainage marks the excavation cut for potential failure due to excessive water loading, fissures are cut by the water's path.
- Surface activities and encumbrances – In addition to the above potential failures, toppling or subsidence may be brought on by the vibrations caused by surface activities near the excavation or by additional weight loading due to the placement of surface encumbrances.

Note: This is the most significant reason for a high frequency of evaluation of the excavation. Drying of the cut walls can significantly alter the structural integrity of the cut, just as too much water can.

Warning - Although these are visual analyses that are to be conducted by the "Employer Designated Competent Person", these are conditions which all field personnel should be aware of throughout the site work. Should you observe any of the above conditions report them immediately to the Competent Person so the excavation may be re-evaluated.

Reminder – All visual/manual test evaluations will be performed in the area of the excavation thought to be the weakest layer!

Manual Tests

The following manual tests may be conducted by the "Employer Designated Competent Person" to determine soil classification.

- Plasticity
 - Mold moist or wet soil samples into balls and then attempt to roll into threads as small as 1/8th inch in diameter by 2 inches in length. (Cohesive materials can be rolled into threads this small and held by the ends without tearing. Granular materials will crumble and tear by this point and are more prone to failure.)

- Dry Strength
 - If the soil is dry and breaks under moderate pressure into individual grains, then the soil is more granular, possibly prone to fissures and cracks and therefore prone to failure.
 - If the soil breaks into clumps, then into smaller clumps, but only with difficulty it is probably clay combination with gravel sand and silt.
 - If the soils break into large clumps which will not break into smaller clumps or only with difficulty then the soils are considered unfissured unless visual indications to the contrary exist.
- Thumb Penetration/Pocket Penetrometer Tests estimates the unconfined strength of saturated cohesive soils measured in tons per square foot (tsf).
 - Stable Rock: Natural solid material which can be excavated with vertical sides and remain intact.
 - Type A Soils (1.5 tsf or greater unconfined strength): The thumb can make an indentation but only with great difficulty. The Pocket Penetrometer should read > 1.5 tsf. Examples of Type A soils include clay, silty clay, sandy clay, and in some cases silty clay loam and sandy clay loam.
 - Type B Soils (0.5 to 1.5 tsf): The thumb readily penetrates the soils, but no greater than the length of the nail. Pocket Penetrometer will read between 0.5 and 1.5 tsf.
 - Type C Soils (<0.5 tsf): Thumb will readily penetrate the soils the length of the thumb. Pocket Penetrometer will read less than 0.5 tsf.

Note: These tests should be run on undisturbed soils. An unsatisfactory result in any of these tests is sufficient grounds to request re-evaluation of the excavation, by the “Employer Designated Competent Person”. Entry should not be attempted until the excavation can be made safe.

Excavation Approval

Approval is granted daily at a minimum, unless occurrences happen which make impact the safety of the excavation:

- Rain Events
- Increased surface encumbrances (i.e., heavier traffic, heavier equipment)

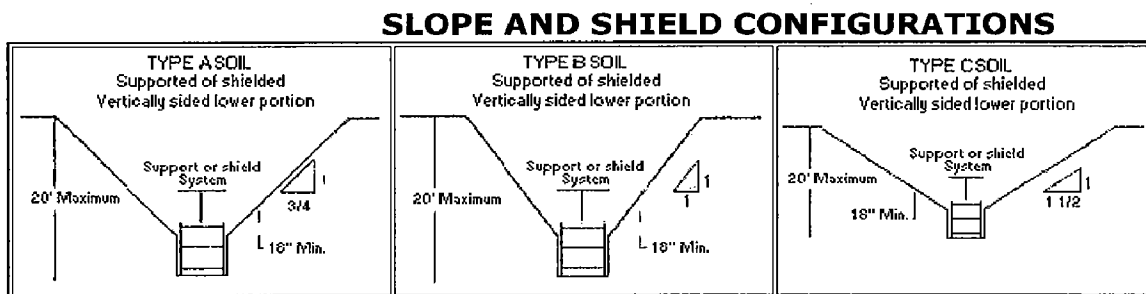
- Changes in atmospheric concentrations (i.e. contaminant-levels or oxygen concentration).

Protective Systems

Once the soil classification is complete, the type of protective system to be used to protect employees entering the excavation maybe determined.

Sloping and Benching

Based on the depth and planned expanse of the excavation sloping and benching may be chosen as a protective system.



The degree of slope or bench is directly related to the soil types involved and their potential for failure. Maximum allowable slopes based on soil configuration is as follows:

Soil Type	Height/Depth Ratio	Slope Angle
Stable Rock	Vertical	90°
Type A Soils	3/4:1	53°
Type B Soils	1:1	45°
Type C Soils	1 1/2:1	34°

These Maximum allowable slopes are based on soil types and the potential for movement. These maximum allowable slopes maybe further reduced by certain conditions which, impact the excavation stability. These may include:

- Surface and subsurface encumbrances
- Surcharge loads

- Operating equipment and traffic
- Other signs of stress

Benches

There are two different types of benches, which may be employed as a protective system. These are simple (a single bench) or multiple benches. Again, the horizontal to vertical ratio of the benches is determined by the soil types.

There is a General Rule of Thumb when to use to determine the bench and depth:

Type A Soils - For the first bench it should not exceed 4 feet in depth with subsequent benches not exceeding 5 feet in depth.

Type B Soils - For first and subsequent benches should not exceed 4 feet in depth.

In all cases the subsequent benches should not exceed the maximum allowable slope.

Shoring or Shielding

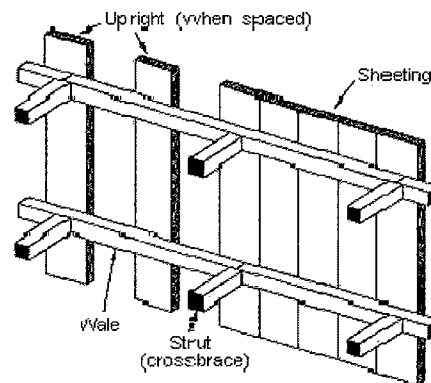
A structural means of supporting the sidewalls of the excavation or trench to protect the workers from accidental collapse, underground utilities, and foundations. For the purpose of this discussion we will focus on worker safety measures.

- The primary consideration when selecting shoring/shielding as an alternative protective system is to ensure the shoring/shielding selected is of adequate construction to support subjected loads. As a general rule of thumb soil weight averages 110 to 140 lb/ft³.
- Efforts will be made not to undermine the shoring and/or shielding systems by greater than two feet.
- Efforts should also be made to ensure excavated vertical walls ascending above the shoring/shielding system is not in excess of 18 inches.
- Insure the shoring/shielding system cannot be laterally displaced.
- Shoring/shielding systems shall be inspected upon arrival at the site to insure structural integrity and then daily as part of the entry approval.

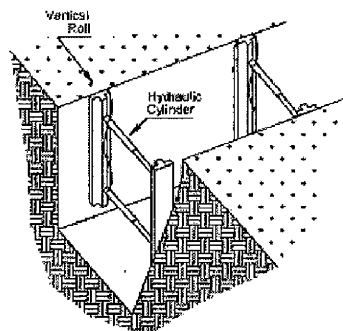
When shoring/shielding is selected as the preferred protection method, the employer designated Competent Person chooses one of four options per Appendix C, Subpart P. They are:

Option 1 - Timber Shoring Appendices A and C.

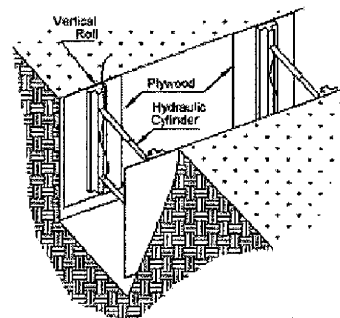
TIMBER SHORING.



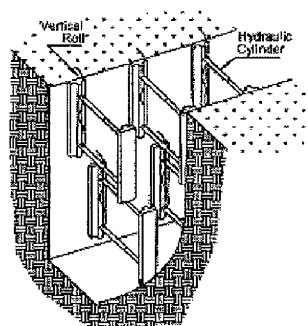
Option 2 – Hydraulic or pneumatic shoring (follow manufacturer's data)



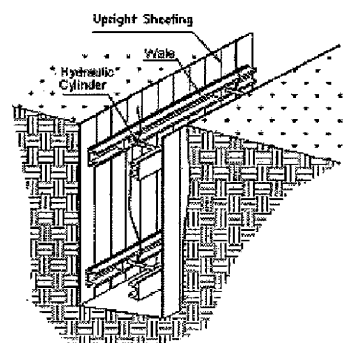
Vertical Aluminum Hydraulic Shoring
(Spot Bracing)



Vertical Aluminum Hydraulic Shoring
(With Plywood)



Vertical Aluminum Hydraulic Shoring
(Stacked)



Aluminum Hydraulic Shoring Waler System
(Typical)

Option 3 – Follow directions as determined through tabulated data

Option 4 – Engineered Systems (i.e., engineered shoring/shielding system)

Some additional considerations to be evaluated by the “Competent Person” including hazardous atmosphere, access and egress, design and installation.

Atmospheric Hazards

Vapor release from environmental media always presents a level of concern for employees and those charged with their safety. Certain conditions and considerations shall be evaluated to quantify and qualify the hazards as they are found at the site. This includes:

- Concentrations of contaminants collecting within the excavation.
- Potential IDLH conditions.
- The contaminant of concern and its propensity for release into the air.
- The ability of the material to accumulate such as in a confined space. By definition excavations and trenches may be considered confined spaces in which the accumulation of off-gases is a potential. To select the proper measures to protect personnel who enter excavations the quantification or qualification of the hazard must be accomplished. Employees will not be permitted to work in a hazardous and/or toxic atmospheres unless provisions have been made to provide engineering controls and personal protective equipment to minimize and/or eliminate the hazards to the employees. Again, the “Employer Designated Competent Person” is responsible for monitoring **all** conditions which may impact an excavation’s safety.

Testing

Testing should be done prior to each entry into the excavation. The frequency thereafter will be determined by:

- Propensity of the contributing source (i.e., contaminated soils vapor generation) to generate the hazardous atmosphere or to change.
- Activities to be conducted within the excavation/trench (i.e., hot work, equipment operation) will also determine frequency and type of monitoring.

Action Levels

Action levels within the trench and/or excavation shall be as follows:

Oxygen levels

<19.5% - Oxygen deficient atmosphere – Supplied Air; ventilate

>23.5% - Oxygen enriched atmosphere – Evacuate, fire and explosion hazard; ventilate to return oxygen levels to 21%.

Combustible Gas levels

<10% Continue to work, continue to monitor

Note: When measuring gases using percent by volume precautions must be taken due to toxic potential. 1% is equivalent to 10,000 ppm. Concentrations up to 10% would equal 100,000 ppm. Concentrations of hazardous materials to this extent would certainly result in toxic effects. In addition displacement of oxygen begins to occur at these levels for gases with a vapor density greater than 1.

>10% Discontinue work; evacuate; ventilate

Toxic gases

Monitor the action levels identified in the site-specific HASP and/or Safe Work Permit for the identified toxic substances.

Note: In addition to monitoring hazardous conditions in the excavation/trench, personnel monitoring shall be cognizant of conditions and areas existing outside of the excavation. An example of this would be the discharge of contaminated air through ventilation then collecting in adjacent low lying areas or subsurface and structures.

Hazard Monitoring Hierarchy

Monitoring should proceed using the following hierarchy to insure the validity of the results obtained:

- 1) Oxygen – Without knowledge of O₂ levels, flammable gas ranges could be inflated or deflated due to the absence of oxygen and the detectors inability to combust the sample.

2) Flammable – Obtaining the O₂ first. Confidence in the flammable readings can only be considered accurate if the oxygen level supports combustibility. As it was explained earlier, these readings are conveyed in percent per volume.

3) Toxic

Note: Monitoring should occur in the in the order presented. In addition, monitoring should be conducted to evaluate the entire space in order to illustrate stratospheric reading of the atmosphere within the trench or excavation.

Physical Hazards

When directed, monitoring for physical hazards may also include those identified through the hazard assessment activities. Physical hazards to be monitored include:

- Noise Monitoring
- Heat/Cold Stress Monitoring
- Radiation level monitoring
- Buried containers

Monitoring will provide an opportunity to qualify/quantify hazards and install necessary control measures.

EXCAVATION ACCESS/EGRESS

The Competent Person to this point has now covered the following items to determine the excavation safe for entry: structure, soil classification, protective systems, and atmospheric monitoring. We now need to consider access and egress from the excavation.

The regulation states that your distance of lateral travel to exit an excavation or trench should be minimal to facilitate escape should it be required. For this reason certain requirements have been established for access and egress and are provided below.

- Structural Ramps (For entry)
 - Designed by a Competent Person qualified in structural design
 - Structural members will be tied together to prevent displacement.
 - Structural members will be of sufficient strength to hold intended loads.

- Structural ramps will be equipped with non-skid surfaces to prevent slips, trips, and falls.
 - Structural ramps will be equipped with handrails and toe boards as per 1910.23(e)
 - Access/Egress points (Stairway, ladder, or ramp) will be placed so that lateral travel does not exceed 25 feet prior to reaching an Access/Egress point.
- Earthen Ramps
 - May be considered safe means for entering and exiting an excavation, provided the personnel may enter and exit walking in an upright manner.
 - Environmental conditions – Rainy, muddy, and/or slippery footing will not impede the ability to escape
 - Presence of obstructions impacting travel – Stock pile or storage which impede travel will not be permitted under any circumstances.

When necessary, hazards associated with earthen ramps may be minimized by use of rope lines, equipment sleds that assist in the entry of equipment. Extreme care should be exercised carrying tools, sample coolers, etc. down earthen slopes or ramps due to slip, trip, and fall hazards.

EMERGENCY RESCUE EQUIPMENT AND PROVISIONS

All preparations are completed our planning must also include the contingency for an emergency. The standard emergency equipment we will be needed on-site in the event of an emergency includes:

- Required Equipment
 - Breathing Apparatus (Rescue – Inspected, ready for use)
 - Safety Harness
 - Lifeline (As necessary. If used must be attended)
 - Basket Stretcher

In addition, site-specific items should be available for routine and foreseeable conditions, which could result in an emergency.

PERIODIC INSPECTIONS

Periodic Inspections will be conducted even though acceptable conditions have been obtained. Frequent inspections and documentation of those inspections will be performed. Conditions associated with an excavation are constantly changing, and require constant attention.

SITE ASSESSMENT QUESTIONNAIRE

The site assessment questions as found in the OSHA Technical Manual are provided as a recap of subject matter covered in this module. These questions will provide a detailed checklist of the considerations whenever you are going to enter an excavation or trench. This questionnaire is found below:

EXAVATION SITE ASSESSMENT QUESTIONNAIRE

#	Assessment Question	Yes	No
1.	Is the cut, cavity, or depression a <i>trench</i> or an <i>excavation</i> ?		
2.	Is the cut, cavity, or depression more than 4-ft (1.2 m) in <i>depth</i> ?		
3.	Is there <i>water</i> in the cut, cavity, or depression?		
4.	Are there adequate means of <i>access</i> and <i>egress</i> ?		
5.	Are there any <i>surface</i> or <i>subsurface</i> <i>encumbrances</i> ?		
6.	Is there exposure to <i>vehicular traffic</i> ?		
7.	Are <i>adjacent structures</i> <i>stabilized</i> ?		
8.	Does <i>mobile equipment</i> have a <i>warning system</i> ?		
9.	Is a <i>competent person</i> <i>in charge</i> of the operation?		
10.	Is <i>equipment operating</i> in or around the cut, cavity, or depression?		
11.	Are procedures required to monitor, test, and <i>control hazardous atmospheres</i> ?		
12.	Does a competent person <i>determine soil type</i> ?		
13.	Was a <i>soil testing device</i> used to determine soil type?		
14.	Is the <i>spoil</i> placed 2-ft (0.6 m) or <i>more from the edge</i> of the cut, cavity, or depression?		
15.	Is the <i>depth</i> 20-ft (6.1 m) or <i>more</i> for the cut, cavity, or depression?		
16.	Has a <i>registered professional engineer</i> approved the procedure if the depth is more than 20-ft (6.1 m)?		
17.	Does the procedure require <i>benching</i> or <i>multiple benching</i> ? <i>Shoring</i> ? <i>Shielding</i> ?		
18.	If provided, <i>do shields extend at least 18 in (0.5 m) above</i> the surrounding area if it is sloped toward the excavation?		
19.	If shields are used, is the depth of the cut <i>more than 2-ft (0.6 m) below the bottom of the shield</i> ?		
20.	Are any required <i>surface crossings</i> of the cut, cavity, or depression the <i>proper width and fitted with hand rails</i> ?		
21.	Are means of <i>egress</i> from the cut, cavity, or depression <i>no more than 25-ft (7.6m) from the work</i> ?		
22.	Is <i>emergency rescue equipment</i> required?		
23.	Is there <i>documentation of the minimum daily excavation inspection</i> ?		

CONCLUSION

Through effective preplanning of an excavation, every effort should be made to avoid having personnel enter the excavation or trench. If that is not possible, efforts must be directed to make the entry/exit safe by considering all potential hazards and providing the subsequent control measures to make the entry safe.

ATTACHMENT VII

TRENCHING AND EXCAVATION

COMPETENT PERSON CHECKLIST

TRENCHING AND EXCAVATION COMPETENT PERSON CHECKLIST						
CTO Name and Number:			Subcontractor:			
FOL:			Location:			
SSO:			Date:			
Weather (circle one)	Dry	Raining	Previous Rain	Freezing		
COMPETENT PERSON INFORMATION				YES	NO	NA
Competent Persons Name:						
<input type="radio"/> Length of Experience:						
Does the designated Individual have training and knowledge in:						
<input type="radio"/> Soil Analysis?						
<input type="radio"/> Use of protective systems?						
<input type="radio"/> Requirements of 29 CFR 1926. 650-652?						
List Training Experience:						
Does the designated individual have the authority to take prompt action and stop work?						
GENERAL						
Was an inspection done and documented prior to the start of work?						
Is the excavation deeper than 4 feet?						
Will entry into the excavation be allowed?						
Do structures (buildings, etc.) exist near the excavation?						
<input type="radio"/> Will the excavation proceed under the footing/foundation?						
<input type="radio"/> What is the method of stabilization?						
Have surface encumbrances been identified?						
Have subsurface encumbrances been identified?						
Is the excavation exposed to heavy equipment/vehicular traffic?						
<input type="radio"/> Have safe distances been marked?						
WATER CONDITIONS						
Has the excavation been subject to water accumulation?						
<input type="radio"/> Has the soil in the trench been adversely affected?						
<input type="radio"/> If yes has the competent person inspected the excavation and taken action?						
EGRESS						
Is a means of egress provided every 25 feet?						
Is a ramp used for access or egress to the excavation? <i>(if no skip to the next section)</i>						

o Was the ramp designed by competent person for safe access and egress?			
o Is the competent person who designed the ramp qualified?			
o Does the ramp meet specifications?			
EGRESS			
Is there a potential for a hazardous atmosphere in the trench?			
Is air monitoring equipment on site?			
Has a qualified person been assigned to assess the hazards of confined space?			
Is emergency rescue equipment readily accessible to employees?			
Comments:			
<div>Competent Person:</div> <div> <div>_____</div> <div>Print Name</div> </div> <div> <div>_____</div> <div>Signature</div> </div> <div> <div>_____</div> <div>Date</div> </div>			

ATTACHMENT VIII

TETRA TECHNUS, INC.

CONFINED SPACE ENTRY

PROGRAM

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ATTACHMENT I- TETRA TECH NUS, INC. CONFINED SPACE ENTRY PROGRAM

**ATTACHMENT II - CONFINED SPACE ENTRY PROGRAM FOR PROJECT SITES INVOLVING
CONFINED SPACES WHERE ENTRIES WILL NOT BE PERFORMED**

ATTACHMENT III - SUBCONTRACTOR PERMIT REQUIRED CONFINED SPACE ENTRY

TETRA TECH NUS

CONFINED SPACE ENTRY PROGRAM

1.0 PURPOSE

To establish a uniform procedure specifying the minimum requirements for confined space entry operations performed by (or managed by) Tetra Tech NUS, Inc.

2.0 SCOPE

For the purpose of clarification, this program applies to confined space operations which falls within the definitions provided below for confined spaces and permit required confined spaces.

2.1 Confined space A confined space means a space that:

- Is large enough and so configured to permit an employee to enter and perform work; and,
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, pits, etc.); and,
- Is not designed for continuous employee occupancy.

2.2 Permit required confined space (PRCS). A confined space having one or more of the following characteristics:

- Contains a hazardous atmosphere, or possesses the potential to contain a hazardous atmosphere.
- Contains a material which has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant entering the PRCS could become entrapped or asphyxiated by inwardly converging walls or a floor which slopes downward, tapering to a smaller cross-section.

- Contains any other recognized serious safety or health hazard, or by virtue of the task to be undertaken, may generate unsafe conditions.

This procedure applies to projects with a scope of work that includes the performance of confined space entry operations by Tetra Tech NUS or subcontracted personnel. This program has been developed on the basis of two principle requirements. These are as follows:

- That this program will be implemented on a **SITE SPECIFIC** basis, establishing flexibility to provide for the protection of the health and safety of Tetra Tech NUS and subcontractor personnel, as well as for internal and regulatory compliance. This concept recognizes that Tetra Tech NUS personnel work on many different sites, often with only brief field operations tasks, as opposed to longer term project sites. Therefore, this performance-based program has been developed to establish the minimum requirements for confined space entry operations at any individual Tetra Tech NUS office location or project site.
- That confined space entry operations will be performed using a **PERMIT-REQUIRED** system, with the requirements of this procedure followed as minimum requirements. Recognizing the Federal OSHA regulatory delineation between a Non-permit Confined Space and a Permit-Required Confined Space¹, and also recognizing that OSHA standards are minimum requirements. It is Tetra Tech NUS policy that confined space entry operations will be performed in accordance with the written permit system specified in this procedure.

3.0 RESPONSIBILITIES

Project Manager (PM)/Task Order Manager (TOM) - The PM/TOM is also ultimately responsible for the effective compliance with these requirements. The PM/TOM will ensure that sufficient information has been provided to the PHSO to develop a site-specific Confined Space Entry Program appropriate for the nature of the planned activities. This is to be accomplished in conjunction with the preparation of the site-specific Health and Safety Plan (HASP). In addition, the PM/TOM will ensure that confined space entry is only considered as a last resort.

¹ Occupational Safety and Health Administration Title 29 CFR 1910.146, Permit-Required Confined Spaces, paragraph (b) "Definitions".

Tetra Tech NUS Health and Safety Manager (HSM): Provide technical management and oversight of this program, and to aid Tetra Tech NUS employees in effectively implementing these requirements. The Tetra Tech NUS HSM will also be responsible for monitoring the overall effectiveness of this program. This will be accomplished by:

- Reviewing completed permits on an annual basis.
- Performing field audits of select project sites where confined space entry operations are performed.
- Maintaining proficiency in regulatory requirements on confined space entry matters.
- Modifying elements of this program, when or as appropriate.
- Establishing minimum components of confined space entry training course material, both for in-house and subcontractor-provided training courses
- Maintaining appropriate record-keeping for this program.

Project Health and Safety Officer (PHSO) - The PHSO shall ensure that confined space activities are adequately addressed in the Site Specific Health and Safety Plan for assigned projects. In addition, it is the PHSO responsibility to provide technical assistance to the SSO and/or the Field Operations Leader. The PHSO must also ensure that the requirements of this program are satisfied for confined space entry operations performed or managed at their location, whether by Tetra Tech NUS personnel or by subcontractors. Other responsibilities include ensuring that:

- If training is provided by subcontractors, that an appropriate organization is selected, and that the training course material satisfies the Tetra Tech NUS requirements.
- No individual participates in any confined space entry operations unless they are fully compliant with program requirements.
- The HSM is alerted when activities at a project site will involve confined space entry operations.
- A properly completed written program is present at every site where confined spaces exist.
- Appropriate documentation is maintained for that office, and that written permits are submitted to the HSM at the conclusion of project activities to facilitate the annual permit review requirement.

Site Safety Officers (SSO): Ensure that the requirements of this program are satisfied for confined space entry operations performed or managed at their site location, whether by Tetra Tech NUS personnel or by subcontractors. Other responsibilities include ensuring that:

- Confined spaces are identified and labeled as such.
- Personnel to participate in confined space are trained to the appropriate level for the tasks to be performed and documentation certifying this training is obtained and maintained on site. In addition, ensure drilling/practice requirements to establish proficiency are up to date.
- Personnel meet the necessary medical qualifications for this type of activity.
- Rescue services are established and confirmed on the dates the confined space operations will be conducted.
- Provide the intended rescue services, the necessary information concerning the hazards associated with the confined space operations. This includes Material Safety Data Sheets, where available, information concerning hazard atmospheres and any associated physical hazards.
- The duties of the Entry Supervisor is completed in their entirety. In many cases the SSO will serve as the Entry Supervisor.
- The site-specific program for confined space operations is completed at each site, where applicable.

Field Operations Leader (FOL) – The FOL may share responsibility with the SSO or in the absence of an SSO ensure the implementation of this program for operations conducted under their direction. Substitution for the SSO will depend on the nature of the confined space operations and the anticipated severity of the hazards conveyed in the confined space. Substitution shall proceed based on the PHSO recommendation.

Tetra Tech NUS Employees - The employees are responsible for following the tenets of this Confined Space Entry Program and/or conditions or modifications of this program, that may be site-specific in nature. In addition the employees are responsible for reporting any deficiencies or inadequacies of these program or site-specific elements to the SSO and/or the FOL.

4.0 PROCEDURES

4.1 Introduction

Tetra Tech NUS recognizes that the participation of Tetra Tech NUS personnel in confined space entry operations can be one of the most potentially dangerous types of field activities that they may encounter in their work. The risks associated with this type of work are most remarkable because they can be immediate and severe. It is for this reason that the requirements of this program will be strictly enforced at Tetra Tech NUS locations.

There are two commonly encountered situations in which Tetra Tech NUS field personnel operate. These include project sites where we are the contractor performing work at a client location, and project sites where we are the prime contractor, and we have a subcontractor working under our direction. Also, specific to addressing confined space concerns, we need to address sites where confined spaces exist but our work scope will not involve entry versus sites where actual entry is necessary. As the regulatory requirements for each of these scenarios vary, separate procedures are established in the following sections of this overall program. These procedures involve the use of a simple, fill-in-the-blank written program that is to be completed

4.2 General Requirements

The following are General Requirements for each Tetra Tech NUS Confined Space Entry policy and program.

Confined space entry operations on any Tetra Tech NUS project site will be performed only a last resort. Available alternative means to accomplish the task objectives must be exhausted before commencing any confined space entry activities.

The following represents scenarios where Tetra Tech NUS, Inc. personnel and/or subcontractor personnel working under the direction of Tetra Tech NUS, Inc. would require the use of this program.

- Tetra Tech NUS, Inc. personnel will enter a confined space.
- There are confined spaces in the area of operation under the guidance/control of Tetra Tech NUS, Inc.

- Subcontractor personnel will enter a confined space under the guidance and/or direction of Tetra Tech NUS, Inc.

Therefore, any project site where planned activities may involve work in or near a confined space must have a written Confined Space Entry Program completed on site and available prior to the commencement of site activities. The program must be attached to the Health and Safety Plan prepared for that project. The written program shall be completed by the assigned SSO, and will be kept current and available for review by the Tetra Tech NUS HSM.

Work involving entry into a confined space will be performed by written permit only. There will be no exceptions to this requirement without the express, written consent of the Tetra Tech NUS HSM.

4.2.1 Role and Responsibility of the Site Safety Officer

For applicable projects, the assigned SSO must be thoroughly familiar with this procedure and with the OSHA regulation on Permit-Required Confined Spaces, and will be responsible for completing the on-site elements of this program. The SSO will also be responsible for implementing the specific requirements of the program on his/her site, including ensuring that:

- Confined spaces at the site are properly identified, labeled, and inventoried. Signs should be appropriate size (12x18 minimum or greater) and color designation
- Site personnel are made aware of these spaces, and that unauthorized entry is prohibited. This is to be covered as part of the site-specific health and safety training.
- Entries are performed using the written permit system specified in the site written program.
- Necessary training requirements are satisfied, and that appropriate training documents are collected and maintained.

- Personnel participating in the confined space operation are medically (physically and psychologically) qualified to do so. Documentation to be provided are the medical surveillance clearance and the ability to wear respiratory protection.
- Necessary entry equipment is on hand, and maintained in proper working order. Equipment will be inspected by the SSO to ensure operation status.
- Permits are completed specifying a duration only long enough to perform the job.
- A trained and equipped rescue team is on standby prior to the beginning of the confined space activity. It will be the SSO responsibility to ensure the rescue teams capabilities and equipment resources to support the planned operation.
- The rescue team is fully aware of the potential hazards which may be encountered and pertinent information has been provided by the SSO.

The SSO will, in the majority of cases, serve as the Entry Supervisor. This means that he/she is responsible for determining that acceptable entry conditions are present before and during entry, for authorizing (by completing and signing the written permits) and overseeing entries, and for terminating entries and canceling permits.

4.2.2 Testing and Monitoring of Confined Spaces

Air monitoring in the confined space must be performed before and periodically during entry operations. The frequency, types, and sequence of air monitoring are clearly specified in the site specific program included as Attachment I. While that program specifies that periodic air monitoring during an entry may be acceptable for an isolated space, it is recommended that continuous monitoring always be performed, even for a completely isolated space. Acceptable entry conditions are as specified in Table 1, below.

Table 1
Acceptable Entry Conditions

Testing Sequence	Atmospheric Parameter	Acceptable Entry Condition
1 st	Oxygen content in air	$\geq 19.5\%$ and $\leq 23.5\%$
2 nd	Flammable or explosive conditions	$\leq 10\%$ of an LEL* for gases, vapors or mists \leq LEL for airborne combustible dusts
3 rd	Toxic concentrations of chemical hazards	Any exposure reaching a substances published Action Level, Permissible Exposure Limit, Threshold Limit Value, or Recommended Exposure Limit. These will be specified in the site Health and Safety Plan
4 th	Any other atmospheric condition that is Immediately Dangerous to Life or Health	Varies by specific parameter

*LEL = Lower Explosive Limit, sometimes also referred to as LFL for Lower Flammability Limit. For dusts, this may be approximated as a visual condition where the dust obscures vision at a distance of 5 feet or less.

If the acceptable entry conditions do not exist, or appear that they may not be constant throughout the entry, the SSO can use the following approach:

- Ensure that the space is properly isolated (block and bleed lines, use Lockout/Tagout procedures, etc).
- Purge, inert, flush, or ventilate the space to control or eliminate the hazard.

If acceptable entry conditions still do not exist due to flammability or explosive concerns, the entry must not be authorized. If the limiting factor is toxic airborne concerns, appropriate PPE may be used to allow the entry (Note: PPE is chosen as a control option always only as a last resort. Efforts should be made to control hazards through engineering controls).

4.2.3 Rescue

When confined space entry operations are performed, personnel and equipment must be adequate and available to effect non-entry rescue operations in the event of an emergency. This

shall include items such as body harnesses (or wristlets, as a second choice), tie-offs, mechanical retrieval apparatus, etc. This equipment must be available and in use during entry operations. This will enable the Attendant and other authorized personnel to perform an emergency rescue and extract an injured person from outside of the space. Rescue procedures requiring other personnel to enter a space to assist or evacuate an injured or incapacitated entrant are expressly prohibited. Also, unauthorized personnel must be prohibited from participating in emergency rescue operations.

It is anticipated that in most instances, we will be prepared to provide non-entry emergency rescue services ourselves, at least to the point of removing an injured person and stabilizing them until professional emergency services can be summoned. The identity of the specific emergency response service and the method for contacting them will be clearly identified on the permit completed by the SSO. At least one member of the team serving in the role of Attendant or Rescue member (a non-entrant) must have current certification in First Aid and CPR. (Note: The person of choice must ensure that Bloodborne Pathogen Program requirements are satisfied whenever First Aid or CPR practice is authorized.)

4.3 Employee Training

Personnel must be adequately trained in order to be authorized to participate in confined space operations. Training must be performance-based so that participants can successfully demonstrate proficiency in performing their assigned duties. Training shall take place before an individual's first assignment, when their assigned duties change, or when changes occur in the site's written program. Also, if a new hazard is suspected that was not addressed in the employee's training, supplemental training will be required. Retraining may also be conducted when through periodic inspections or reviews identify deficiencies in confined space operations.

Whether training is provided in-house or by a training contractor, the contents of the training must satisfy the requirements of this program, and will be held to the criteria published by the Hazardous Waste Action Coalition Risk Management Committee, Health and Safety Subcommittee (entitled "Confined Space Entry Training Courses", published in 1996). A copy of these criteria are available from the Tetra Tech NUS HSM. These criteria are directly applicable as they have been specifically developed by health and safety representatives of firms from within our industry (hazardous waste/environmental consulting).

The SSO will ensure that appropriate training has taken place for authorized individuals, and will have on-hand at the site documentation for each involved employee attesting to:

- Employee name
- Signature or initials of the instructor
- Dates of training

Site-specific training for authorized individuals will cover the duties of the entrants and attendants. This will address the aspects for each of these positions as presented below.

4.3.1 Authorized Entrants Training

- Hazards that may be encountered in the space
- How to properly use the necessary equipment
- Communication methods with the Attendant
- Recognizing when emergency exit of the space is necessary

4.3.2 Attendant Training

- Hazards that may be encountered in the space
- Behavioral effects of hazard exposure
- To continuously maintain an accurate count of entrants and know their identity
- To never leave the space unless relieved by another attendant
- Communication methods and aspects with Entrants
- Monitoring of the space
- How and when to summon emergency services
- Control unauthorized personnel issues
- Performance of non-entry rescues

4.3.3 Entry Supervisor Training

- Hazards that may be encountered in the space
- Verifies that tests have been conducted (by checking permit entries)
- Verifies that procedures and equipment specified in the permit are in place before signing it and putting it into effect
- When and how to terminate the entry and cancel the permit

- Verify that rescue services are available at the time of the entry and that the means for summoning them are operable
- Removes or prevents unauthorized personnel from entering the space

4.4 Coordination with Clients

Tetra Tech NUS operations will involve arrangements where we are serving as a contractor to a client facility. That is, we will not be addressing entering spaces that we own or control. Therefore, appropriate coordination with the client representative will be essential to properly understand the nature of any confined spaces and to successfully perform the work. When the scope of work entails (or may entail) working in or near confined spaces, the PM/TOM must gather the following information as part of the initial data gathering process:

- Obtain any available information regarding confined spaces, including descriptions, potential or known hazards, and the client's confined space entry program information.
- Determine, if the client has located and designated confined spaces in the work area.
- Establish how the client desires to coordinate our work with their operations, relative to the confined spaces.
- If the scope of work will involve actual entry by Tetra Tech NUS personnel, inform the client of our program.

Gathered information is to be provided to the PHSO responsible for preparing the site-specific Health and Safety Plan.

At the conclusion of any confined space entry work done at a client location, the PM/TOM is to request a debriefing meeting, so that a representative from the project team can communicate hazards that were encountered in the work.

4.5 Project Sites Involving Confined Spaces Where Entries Will Not Be Performed

In many instances, we may be performing work at sites where confined spaces exist and our scope of work does not involve any entry into those spaces. In this application, the SSO has only to ensure that spaces in our work area are adequately identified and posted, and complete the one-page written program in Attachment II and post it on site in the work area.

4.6 Confined Space Entry Operations Involving Subcontractors

For some projects, the scope of work may require a specialized of a subcontractor. When the work involves requiring a subcontractor to perform a confined space entry, the SSO must complete and utilize the written program included as Attachment III. We must provide our subcontractor with the following information:

- Information regarding the confined space(s), including descriptions, potential or known hazards, and the details of our confined space entry program.
- Information on the location and designations (postings) of the confined spaces in the work area.
- Establish how we desire to coordinate our work with their operations, relative to the confined spaces.
- If the scope of work will involve actual entry by subcontractor personnel, inquire if they have their own Permit-Required Confined Space Program and obtain it for our review.
- If the nature of the work is such that Tetra Tech NUS and subcontractor personnel will have to perform concurrent operations in or near a confined space, very close coordination will be necessary and the Tetra Tech NUS HSM must be contacted for guidance.

At the conclusion of any confined space entry work done by a subcontractor, a debriefing meeting will be held by the SSO to learn of any hazards that were encountered in the work.

4.7 Program Evaluations and Availability

The Tetra Tech NUS HSM is responsible for performing evaluations of this overall Program to ensure its continued effectiveness. These reviews will be properly documented, and will occur as follows:

- Annually, at the end of each calendar year.
- At any time when an indication is discovered that a component of the program is not effective.
- In the event of any modifications in the regulatory requirements for confined space operations.
- If the event of changes or mandates from Tetra Tech, Inc. Corporate Health and Safety.

Annual Program evaluations will entail a review of canceled written permits prepared and used during the course of that year by Tetra Tech NUS locations. The various site-specific written programs that these permits were prepared under are also subject to review. Canceled permits will be retained by the Tetra Tech NUS HSM for no less than one calendar year.

Field audits of project work sites where confined space operations are conducted will also be performed. These will be coordinated through the Tetra Tech NUS HSM , and will do on an unannounced, random basis.

Information gathered and program modifications that become necessary will be communicated to Tetra Tech NUS personnel by the Tetra Tech NUS HSM.

4.7.1 Equipment and Evaluation of Confined Spaces

Spaces must be properly evaluated before and during entry operations. Figure 2 specifies the criteria for equipment inspections that will be maintained on this site to evaluate and support Confined Space Entry operations.

4.7.2 Confined Spaced Signage

Each of these spaces have been (or will be, upon creation) clearly posted with signs stating "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or "DANGER - CONFINED SPACE - DO NOT ENTER" as applicable.. Unauthorized entry into any of these spaces is strictly prohibited.

The remaining text represents the site-specific portion of this program and the activities to be conducted when involved in one or more of the scenarios defined above.

5.0 DEFINITIONS

Acceptable entry conditions - The conditions that must exist and be maintained in a confined space in order to allow entry and work activities to be performed by personnel. For purposes of this program, this definition will also reflect those conditions which must be maintained and must not be compromised. Therefore, acceptable entry conditions are defined as, but not limited to, the following:

- A "hazardous atmosphere" either does not exist, or it can be adequately controlled to allow entry. Examples of control measures may include ventilating, purging, or inerting the PRCS, or a combination of these measures. Additionally, the use of appropriate personal protective equipment may be considered a control measure when other engineering and administrative controls are not feasible or are unable to be adequately controlled.
- The space to be entered has been properly isolated. This involves ensuring that energy sources have been identified and secured in a zero energy state to the greatest possible extent. This is accomplished through the use of energy control measures such as lockout procedures, blanking or blinding techniques, double block and bleed procedures, or other appropriate energy control methods. This effort must be documented, and members associated with the entry must concur that control sources have been identified, tested, and are disabled.
- The space to be entered does not contain a material that could engulf an entrant. If such a material is involved, adequate control methods such as shoring or sloping of the material must be adequately implemented prior to initiation of the entry.
- The space to be entered does not contain any other serious hazard potential(s) which cannot be contained or controlled to the satisfaction of the entry supervisor.

Attendant - An individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs attendant's duties assigned by this Confined Space Entry Program.

Authorized entrant - An employee who is authorized by Tetra Tech NUS to enter a confined space or a permit required confined space.

Blanking or blinding - The absolute closure of a pipe, line, or duct by the fastening of a solid plate that completely covers the bore, which ensures no leakage occurs beyond the plate.

Confined space. A confined space means a space that:

- Is large enough and so configured to permit an employee to enter and perform work; and,
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, pits, etc.); and,
- Is not designed for continuous employee occupancy.

Double block and bleed - The closure of a line, duct, or pipe by closing and locking two in line valves and by opening and locking a drain or vent valve in the line between the two closed valves.

Emergency - Any occurrence (including any failure of hazard control or monitoring equipment) or event internal and/or external of the confined space and/or permit-required confined space, that could endanger entrants.

Entry - The action by which a person passes through an opening into a confined space. Entry includes ensuing work activities that are performed in the confined space. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the confined space.

Entry permit - The written or printed document which is provided by the employer to allow and control entry into a confined space and/or a permit required confined space. The permit contains pertinent information regarding the space to be entered.

Entry supervisor - The person responsible for determining if acceptable entry conditions are present the confined space and/or the permit required confined space where entry is planned. The Entry supervisor is also responsible for authorizing entry, overseeing entry operations, and for terminating the entry as conditions dictate.

Hazardous atmosphere - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit -LEL (sometimes referred to as the lower flammable limit - LFL).
- Airborne combustible dust at a concentration that meets or exceeds 10 percent of its LEL/LFL.
- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent.
- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is established. Also an atmospheric concentration which could impede the entrant's ability to self rescue resulting in employee exposure and adverse health effects associated with that exposure.
- Any other atmospheric condition that is immediately dangerous to life or health.

Hot Work Permit - The employer's written authorization to perform operations (e.g., welding, cutting, burning, heating, etc.) capable of providing a source of ignition.

Immediately Dangerous to Life or Health (IDLH) - Any condition which poses an immediate or delayed threat to life, or a condition that would cause irreversible adverse health effects. In addition, an IDLH condition includes any condition which would interfere or impede an individual's ability to escape unaided from a confined space and/or a permit-required confined space.

Inerting - The displacement of the hazardous atmosphere in a permit-required confined space by introducing a non-reactive gas (such as nitrogen) to such an extent that the resulting hazardous atmosphere would be pushed from the permit-required confined space rendering that permit-required confined space non-reactive. Inert spaces are still considered hazardous due to the displacement of oxygen.

Isolation - The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as:

- blanking or binding;
- misaligning or removing sections of lines, pipes, or ducts;
- a double block and bleed system;
- lockout of energy sources, and the reduction of potential energy sources to their zero mechanical state;

- blocking or disconnecting mechanical linkages.

Line breaking - The intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or by the SSO.

Lockout - [As defined by OSHA 29 CFR 1910.147 (b)] The placement of a lockout device on an energy isolating device, in accordance with an established procedure, which ensures that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Permit required confined space (PRCS). A confined space having one or more of the following characteristics:

- Contains a hazardous atmosphere, or possesses the potential to contain a hazardous atmosphere.
- Contains a material which has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant entering the PRCS could become entrapped or asphyxiated by inwardly converging walls or a floor which slopes downward, tapering to a smaller cross-section.
- Contains any other recognized serious safety or health hazard, or by virtue of the task to be undertaken, may generate unsafe conditions.

Permit system - The employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition - Any condition in a confined space and/or a permit-required confined space that is not allowed by the permit during the period when entry is authorized.

Tagout - [As defined by OSHA 29 CFR 1910.147 (b)] The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed. It should be emphasized that any time tagout is employed as an energy control measure, it must offer the same level of protection as its energy control measure counterpart lockout.

Testing - The process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space. Details pertaining to testing methods and procedures are discussed in Section 4.4 of this program.

ATTACHMENT I

TETRA TECHNUS, INC. CONFINED SPACE ENTRY OPERATIONS

PROJECTS SITES INVOLVING CONFINED SPACE ENTRY OPERATIONS

The written program presented will be used at Tetra Tech NUS project sites where confined space entry operations are planned. That program has been developed to provide the SSO with a standardized tool to serve two purposes:

- To protect the health and safety of Tetra Tech NUS and subcontractor personnel working in or near confined spaces.
- To comply with Federal regulatory requirements.

PERSONNEL RESPONSIBLE FOR PROGRAM COMPLETION

The following persons are available to provide assistance in elements of this program including question/conflict resolution and modification variances. These persons exercise the primary responsibility for the implementation of this site-specific program.

Site Safety Officer: _____ **Phone #:** _____

Field Operations Leader: _____ **Phone #:** _____

Project Health and Safety Officer: _____ **Phone #:** _____

Health and Safety Manager: _____ **Phone #:** _____

PERSONNEL WHO WILL PARTICIPATE IN CONFINED SPACE OPERATIONS

The following list of personnel, represent personnel or subcontractor personnel working under the provision of this confined space entry program. The persons listed below represent only those who will actively engage in confined space operations by way of assignment.

Personnel Name and Signature	Role in the Confined Space Entry Program	Confined Space Training (Dates)		Medical Clearance (Date)	Comments <i>i.e., most recent drill (vertical/horizontal); First-Aid Training</i>
		Initial	Refresher		

RESCUE SERVICES

The _____ Rescue Department will serve as the identified rescue service.

The rescue service can be obtained at (____) ____-____. The entry operation will be coordinated through the rescue service. Pertinent information will be provided prior to entry. Notification shall take place prior to, and after entry operations cease.

CONFINED SPACE INVENTORY/STATUS

The following inventory represents the confined spaces at this project site. These spaces are listed by way of planned entry or proximity. This list will be updated by the SSO and/or the FOL as necessary.

CONFINED SPACE INVENTORY/STATUS

Confined Space/Permit-Required Confined Space Identified	Location/ Tasks To Be Conducted	Type of Entry	<u> Hazards Identified </u>	<i>1.1.1.1.1.1.1.1 Control Measures</i>

CONFINED SPACE ENTRY PERMIT

Entries into Identified Confined Spaces Will Be By Written Permit Only.

The Confined Space Entry Permit will guide and direct field personnel regarding aspects of the entry by using the permit as a checklist. It is based on this application that no spaces on the permit be left unchecked.

The assigned authorized entrant(s) and attendant(s) will complete the Confined Space Entry Permit. However, entry is not permitted until the Entry Supervisor reviews the permit and signs off.

Figure 1 will be used as the written permit on this site. Permits will be reviewed, issued, and canceled by the SSO, who will also serve in the role of Entry Supervisor. Permits must be completed before any entry operations begin. Completed permits will be reviewed with involved personnel as part of their task-specific training, and then posted at or near the entrance to the space.

HAZARD MONITORING

Spaces will be initially evaluated by the Authorized Entrant and Attendant as follows:

- Pre-entry, to determine that satisfactory entry conditions exist
- Continuously, if the space cannot be isolated – For activities at _____
- Periodically, if the space can be isolated (at least once every ___ minutes)

The sequence for conducting these evaluations will be (from first to last):

1. Oxygen level
2. Lower Explosive Level (for gases, vapors, mists, or particulates)
3. Toxic gases or vapors

Specific equipment and instrument action levels are specified on the permit.

Information derived from the monitoring activity will be recorded on the Entry Permit. This information will be used to determine if acceptable entry conditions exist and whether entry is permitted. The SSO will review the information collected and authorize entry, if conditions are determine to be acceptable.

Figure 1

CONFINED SPACE ENTRY PERMIT

CONFINED SPACE ENTRY PERMIT

No: _____

INITIAL ATMOSPHERIC TESTS PERFORMED

CAUTION: Toxic or flammable gasses or vapors may _____ in the confined space. Be sure to vent at various intervals and locations within the confined space. Always check the oxygen content first.

INITIAL TESTING						
HAZARD TESTED	ACCEPTABLE RANGE	READING	DATE AND TIME	TESTER INITIALS	ACCEPTABLE	
					YES	NO
%Oxygen	19.5-23.5%	%				
%LEL	10% or less	%				
	PEL=	PPM=				
	PEL=	PPM=				
	PEL=	PPM=				

EVACUATION PROCEDURE

Route: _____

Assembly Points: _____

RESCUE PROCEDURE – Initiate self rescue, if incapacitated; initiate external extraction; If unable to facilitate external extraction; notify the Fire Dept. for entry and removal

PLAN DESCRIPTION

ON-SITE RESCUE CONTACTS			OUTSIDE SOURCES AND PHONE
PHONE NUMBER	RADIO NUMBER	PAGER NUMBER	
(252) 335-6222			FIRE DEPARTMENT
			AMBULANCE
			HOSPITAL
			OTHER

SPECIAL EQUIPMENT NEEDED

- ☐ RESPIRATORS (Type): _____
☐ SAFETY HARNESSES/WRISTLETS
☐ LIFELINES
☐ HOISTING APPARATUS
☐ VENTILATION EQUIPMENT: _____
☐ TEMPORARY LIGHTING (Type/voltage): _____
☐ NON-SPARKING TOOLS
☐ PROTECTIVE CLOTHING: _____
☐ OTHER: _____

ENTRY SUPERVISOR'S SIGNATURE	DATE	PERMIT RECEIVER SIGNATURE	DATE
------------------------------	------	---------------------------	------

CONFINED SPACE ENTRY PERMIT**No:**

GENERAL INFORMATION:

DESCRIPTION OF THE CONFINED SPACE:

DATE ISSUED	TIME ISSUED :	DATE EXPIRES	TIME EXPIRES :
ENTRY SUPERVISOR			
ATTENDANT(S)			
COMMUNICATION BETWEEN ATTENDANT(S) – ENTRANTS			
‘ VOICE	‘ LIGHT	‘ RADIO	‘ OTHER
DESCRIPTION OF WORK:			

CHECKLIST FOR ISOLATION AND UNAUTHORIZED ACCESS PREVENTION

	Yes	NO	NA	INITIAL
External Battery(ies) in Place	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Mechanical Lockout/Tagout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Lines/Pipes Disconnected	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Lines/Pipes Blocked	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Lines/Pipes Capped	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Lines/Pipes Blinded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Warning Signs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

 REPORT ANY UNAUTHORIZED ENTRY TO:
Health Sciences Department and Project Management

PHONE NO.

RADIO NO.

PAGER NO.

PRE-ENTRY CHECKLIST**PURGING, INERTING, OR FLUSHING**PERFORMED ☐ YES ☐ NO ☐ NA
 METHOD USED ☐ Nitrogen ☐ steam
☐ Water ☐ Other (specify) _____
MECHANICAL VENTILATION

Estimated Confined Space Volume: _____

Air Exchange Rate Required: _____

	Initial	Continuous	Partial	Description
Fresh Air Injection	<input type="checkbox"/> ____ hrs.	<input type="checkbox"/>	<input type="checkbox"/>	_____
General	<input type="checkbox"/> ____ hrs.	<input type="checkbox"/>	<input type="checkbox"/>	_____
Local Exhaust	<input type="checkbox"/> ____ hrs.	<input type="checkbox"/>	<input type="checkbox"/>	_____

SPECIFIC HAZARDOUS TASKS

Certain tasks performed in confined spaces greatly increase the risks to entrants. Check tasks to be performed.

- | | |
|--|---|
| <input type="checkbox"/> WELDING/GRINDING | <input type="checkbox"/> PAINTING OR CLEANING WITH SOLVENTS |
| <input type="checkbox"/> THERMAL CUTTING | <input type="checkbox"/> CLEANING/SWEEPING/VACUUMING |
| <input type="checkbox"/> SOLDERING/BRAZING | <input type="checkbox"/> SCRAPING/REMOVING RESIDUE |
| <input type="checkbox"/> ELECTRICAL | <input type="checkbox"/> CHEMICAL USE |
| <input type="checkbox"/> OTHER, EXPLAIN: _____ | |

Additional Permits Required ☐ Hot Work Permit☐ Utility Locating/Excavation Clearance

ENTRY SUPERVISOR'S SIGNATURE	DATE	PERMIT RECEIVER SIGNATURE	DATE
------------------------------	------	---------------------------	------

CONFINED SPACE ENTRY PERMIT**No:** _____**PERIODIC ATMOSPHERIC TEST RESULTS**

TESTER INFORMATION	ATMOSPHERIC HAZARD TESTED	ACCEPTABLE RANGE OF HAZARD	HAZARD MONITORING RESULTS	ACCEPTABLE	
				YES	NO
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		
Date	Oxygen Content (%O ₂)	19.5%-23.5%	%		
Time:	Combustible Gas (%LEL)	0%-10%	%		
Initials:	Other (Specify)	PEL ppm	Ppm		

EQUIPMENT INSPECTION

Equipment to be used in support of the confined space operation(s) will be inspected by the SSO or duly appointed representative, prior to initial use. Inspections will entail a physical examination and an operational check. The Confined Space Equipment Inspection Record will be used to document these inspections. Where appropriate existing inspection records for instance Respiratory Equipment Checklist will be used in place of the Confined Space Equipment Inspection Record.

PERMIT TERMINATION

A confined space entry permit can be terminated for a number of reasons. These include, but not limited to, the following:

- Scope of work change
- Acceptable conditions within the space change
- Time limit expires
- Planned activities are completed

Upon termination of an active permit the following steps will take place.

- The Confined Space Permit and any other associated permit (Safe Work Permit, Hot Work Permit, etc.) or hazard monitoring results will be copied. The copies will be forwarded to the PHSO for evaluation.
- Upon evaluation the PHSO will forward the copied permits to the HSM for record-keeping and review. The PHSO will include any relevant comments for the HSM to be considered during his/her review.
- The HSM will maintain the completed permits and associated materials for a period of one year from the date of issue.

TYPE OF EQUIPMENT	Visual Condition	Operational Status	
Testing and Monitoring Serial # <div>_____</div> <div>_____</div> <div>_____</div> <div>_____</div> <div>_____</div>	<div>Acceptable Needs repaired</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>	<div>Calibrates</div> <div>Yes No Span Concentration</div> <div> <input type="checkbox"/> <input type="checkbox"/> _____ <input type="checkbox"/> <input type="checkbox"/> _____ <input type="checkbox"/> <input type="checkbox"/> _____ <input type="checkbox"/> <input type="checkbox"/> _____ <input type="checkbox"/> <input type="checkbox"/> _____ </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>
Ventilation Equipment Fans/blowers (Flow rate/per unit _____) Compressor unit (as applicable) Hoses/Connections (as applicable) Power Cords/Connections (as applicable) Back-up Energy Source	<div>Acceptable Needs repaired</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>	<div>Confined Space</div> <div>Estimated Volume: _____</div> <div>Ventilation Unit Flow Rate</div> <div>Input: _____ Exhaust: _____</div> <div>Estimated Changes/Hour: _____</div> <div>_____</div> <div>_____</div> <div>_____</div>
Lighting Equipment (Intrinsically Safe) Power Cords Connections and Plugs Protective Cages Ground Fault Interrupter Back-up Energy Source	<div>Acceptable Needs repaired</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	<div>Adequate lighting for safe operations? Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div> <div>_____</div>
Site Preparation Warning/Hazard Signs (Size, Legible, Correct Color Designation) Barrier Systems (Tape, fencing, etc.) Traffic Control Provisions (Foot & Vehicular) Energy Control Provisions Additional Permits Required (Hot, Excavation, Energy Control, etc.) Permits Posted	<div>Acceptable Unacceptable</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A </div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div> <div>Comments: _____</div> <div>_____</div> <div>_____</div>	

TYPE OF EQUIPMENT	Visual Condition	Operational Status	
Communications Equipment Type _____ Intrinsically Safe? Back-up Communication method? ____ Will line of sight be maintained during the entry operations? Will relay points be established to support radio communications?	<div>Acceptable Unacceptable</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A </div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	Comments: _____ _____ _____ _____ _____ _____ _____
Rescue/Emergency Equipment Retrieval/Fall Arresting Systems [Tripods, Hoist(extraction cables, connections), lifeline, harnesses] Stretcher Fire Extinguishment -Type_Rating____ First-Aid Equipment/Supplies	<div>Acceptable Needs repaired</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	<div>Functional</div> <div>Yes No</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	Method/Meansto summon Rescue Team provided? <input type="checkbox"/> Yes <input type="checkbox"/> No Hazard Information regarding The space to be entered been Provided to the Rescue Team? <input type="checkbox"/> Yes <input type="checkbox"/> No Procedures for Self or Non-Entry rescue been Accomplished? <input type="checkbox"/> Yes <input type="checkbox"/> No If no why not? _____ _____ Comments: _____ _____ _____
Personal Protective Equipment Hard Hat Safety Glasses Splash Shield Splash Suits Type _____ Steel Toe Work Boots Chemically Resistant Overboots Hearing Protection Gloves – Type _____ Heat Shielding	<div>Acceptable Unacceptable N/A</div> <div> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> </div>	Comments: _____ _____ _____ _____ Respiratory Protection: Attach Respiratory Protection Checklist.	

RECORD KEEPING

The following represent records to be maintained on-site supporting confined space entry operations. As stated in the administrative guidelines, these records will be copied upon completion and submitted to the PHSO and/or the HSM for review and evaluation. Records to be maintained are as follows:

Completed Elements of this Program

- Completed Confined Space Entry Permits
- Associated Safe Work Permits, Hot Work Permits, Excavation Permits, as applicable.
- Training Records
 - Confined Space Training Records (To define level of training – Entry Supervisor, Authorized Entrant, Attendant, Rescue). These records should identify initial and refresher dates and be accompanied by official Certificates of Training.
 - Site Specific Training Documentation of this completed Program.
- Medical Surveillance Evaluations

GENERAL REQUIREMENTS AND RESPONSIBILITIES

Only properly authorized and trained personnel will be permitted to participate in entry operations. The Entry Supervisor (the site Health and Safety Officer) will be responsible for conducting these authorizations and for ensuring that training requirements are satisfied. Persons involved with entry operations will be properly designated on the Permit. At least one Entry Attendant will be stationed outside of the space at all times during any confined space entry operation. The identity of the Attendant(s) will be clearly indicated on the entry permit. Attendants will not be assigned any additional duties that could interfere with fulfilling their responsibilities as space Attendants. **Multiple spaces will not be monitored by a single attendant.** This type of approach is strictly prohibited.

Emergency rescue operations will be non-entry means only. Emergency procedures will be specified on the entry permit.

If entry operations will involve the use of contractor personnel, the Subcontractor Permit Required Confined Space Program (See Attachment III of the Tetra Tech NUS Confined Space Entry Operations Program) must be completed by the site Health and Safety Officer and maintained onsite.

At the conclusion of entry operations, the SSO will ensure that personnel and equipment have been removed from the space, that a final space evaluation is performed, and the permit will be canceled and filed. A copy of the canceled permit must be sent to the Tetra Tech NUS Health and Safety Manager at the conclusion of the project, and not later than by November 30 for projects where work continues toward the end of a calendar year in order to facilitate the annual program evaluation process.

ATTACHMENT II

CONFINED SPACE ENTRY PROGRAM For Project Sites Involving Confined Spaces Where Entries Will Not be Performed

CONFINED SPACE ENTRY PROGRAM
For
Project Sites Involving Confined Spaces
Where Entries Will Not be Performed

Site Name and Address: _____ Project No. _____

Project Manager/Task Order Manager: _____

Site Manager: _____

Site Safety Officer: _____

Confined spaces that exist (or that may be created by project activities) at this site include the following: _____

Each of these spaces have been (or will be, upon creation) clearly posted with signs stating "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER".

Entry into any of these spaces is NOT permitted by site personnel is for any reason.

Site Manager: _____

Date / /

Site Safety Officer: _____

Date / /

POST THIS ON SITE

ATTACHMENT III

SUBCONTRACTOR PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

SUBCONTRACTOR PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

Site Name and Address: _____ Project No. _____

Project Manager/Task Order Manager: _____

Telephone Number: (____) ____-____

Site Manager: _____

Site Safety Officer: _____

Subcontractor Performing Confined Space Entry Operations: _____

1.0 General

This project site contains the confined spaces specified in Table 1. Entry into any of these spaces will be written permit only, and in compliance with the requirements of OSHA 29 CFR 1910.146. Permits will be coordinated with and submitted to the site Health and Safety Officer.

Table 1
Confined Spaces
at the
_____ **Site**

Space	Reason For Entry	Associated Hazards

2.0 Space Description and History (Note to SSO: this section must be filled out for EACH space to be entered by the subcontractor personnel. Attach additional pages to this program as appropriate.)

The nature of the work to be performed by _____
(name of subcontractor)

is _____

This will involve/require entry into _____
(description of space)

The hazards recognized or anticipated with this space include or may include (check and describe at apply):

_____ a hazardous atmosphere involving _____

_____ Material that could engulf an entrant, specifically _____

_____ An internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section _____

_____ Other serious safety or health hazards _____

Tetra Tech NUS has implemented the following precautions/procedures for the protection of our employees in or near this space:

- Education and training on confined space recognition
- Posting with "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or "DANGER - CONFINED SPACE - DO NOT ENTER" signs
- Other means as follows: _____

If Tetra Tech NUS and _____ will need to perform concurrent operations in or near the space, activities will be conducted in accordance with the following coordinated system: _____

3.0 Subcontractor Debrief

Work was concluded on ____/____/____. The following confined space hazards were confronted or created during entry operations.

Problems encountered in administering or complying with the site Confined Space Entry Program were as follows:_____

Suggestions for improvements of this program discussed during the debrief included

Signature of Subcontractor Agent

SSO Signature

ATTACHMENT IX

HEAVY EQUIPMENT INSPECTION

CHECKLIST

Heavy Equipment Inspection Checklist

Company: _____

Unit/Serial No#: _____

Inspection Date: ____ / ____ / ____

Time: ____ : ____

Equipment Type: _____

(e.g., earthmoving equipment - tractors backhoes, bulldozers, etc.)

Project Name: _____

Project No#: _____

Yes	No	NA	Requirements	Comments
			Seat Belts	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Are available for intended operator and passengers (where applicable)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Seat Belts are operational?	
			Roll-Over Protection (ROPS)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Roll-over protection structures (ROPS) are provided on vehicles and heavy equipment (including scrapers, tractors, loaders, bulldozers, carryalls, etc.)	
			Brakes	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Brake systems capable of stopping and holding fully loaded equipment	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Parking Brake functions properly	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Wheel Chocks available (where and as applicable)	
			Access	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Non-slip steps	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Grab Handles (3-Point Grab/Step Mounting Points)	

Yes	No	NA	Requirements	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>Audible Alarms</p> <ul style="list-style-type: none"> • Audible alarms – All bidirectional machines, such as rollers, compacters, front-end loaders, bulldozers, and similar equipment, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> - Back up Alarms – All self propelled equipment with an obstructed view to the rear will be equipped with a reverse gear signal alarm distinguishable from the surrounding noise level. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> •Horn functioning properly 	

Yes	No	NA	Requirements	Comments
			Highway Use	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Fenders for equipment that can exceed 15mph	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Fire Extinguisher	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Are exhaust emissions directed away from the Operator?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Cab	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Clean, free from debris, tools or equipment that can interfere with foot Control.	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Free from storage of flammable material/solvents	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Mirrors,	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Safety glass	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Equipped with defrosters	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- Windshield wipers	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Turn signals, lights, brake lights, etc. (front/rear) for equipment approved for highway use?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Gauges functioning properly	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Tires (Tread) or tracks	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Steering (standard and emergency)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Are tools and material secured to prevent movement during transport?	
			Fluid Levels:	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Engine oil	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Transmission fluid	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Brake fluid	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Cooling system fluid	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Hoses and belts	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Hydraulic oil	

Yes	No	NA	Requirements	Comments
			Fueling	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Fueling of vehicles and heavy equipment is done with the engine off. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> No smoking is permitted at or near the fuel storage or refueling area. A sign is posted stating: NO SMOKING WITHIN 50 FEET. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> No sources of ignition are present near the fuel storage or refueling area. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> A dry chemical or carbon dioxide fire extinguisher (rated 6:BC or larger) is in a location accessible to the fueling area, no closer than 50-feet. 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Safety cans available? 	
			Safety Guards –	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Around rotating apparatus (belts, pulleys, sprockets, spindles, drums, flywheels, chains) all points of operations protected from accidental contact? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Hot pipes and surfaces are protected from accidental contact? 	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> High pressure pneumatic lines have safety cable to prevent thrashing should it become disconnected? 	
			Attachments	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<ul style="list-style-type: none"> Have the attachments designed for use (as per manufacturer's recommendation) with this equipment been inspected and are considered suitable for use? 	

Yes	No	NA	Requirements	Comments
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Operator Qualifications	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Does the operator have proper licensing where applicable, (e.g., CDL)?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Does the operator, understand the equipment's operating instructions?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Is the operator experienced with this equipment?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Is the operator 21 years of age or more?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PPE Required	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Hardhat	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Safety glasses	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Work gloves	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical resistant gloves_____	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Steel toed Work Boots	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical resistant Boot Covers	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Apron	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Coveralls Tyvek, Saranex, cotton)_____	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Key(s)?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Operating Manual?	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other Hazards	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Excessive Noise Levels _____ dBA	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	• Chemical hazards (Drilling supplies - Sand, bentonite, grout, fuel, etc.)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	- MSDSs available?	
Approved for Use			<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> See Comments	

Site Health and Safety Officer

Operator

ATTACHMENT X

OSHA HEALTH & SAFETY

CONSTRUCTION-RELATED

REGULATIONS - P - 650 TO 699

SUBPART P - EXCAVATIONS

OSHA Health & Safety Construction-related Regulations - P - 650 to 699

Subpart P - Excavations

§ 1926.650 - Scope, application, and definitions applicable to this subpart.

(a) *Scope and application.* This subpart applies to all open excavations made in the earth's surface. Excavations are defined to include trenches.

(b) *Definitions applicable to this subpart.*

Accepted engineering practices means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-bottom pier hole means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a belled shape.

Benching (Benching system) means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-in means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or otherwise injure and immobilize a person.

Competent person means one who 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.

Cross braces mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or sides means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous atmosphere means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout means the accidental release or failure of a cross brace.

Protective system means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield system) means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either premanufactured or job-built in accordance with 1926.652(c)(3) or (c)(4). Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring system) means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping system) means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable rock means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural ramp means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support system means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated data means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m). If forms or other structures are installed or constructed in an excavation so as to reduce the dimension measured from the forms or structure to the side of the excavation to 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench box. See "Shield."

Trench shield. See "Shield."

Uprights means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

§ 1926.651 - Specific excavation requirements.

(a) *Surface encumbrances.* All surface encumbrances that are located so as to create a hazard to employees shall be removed or supported, as necessary, to safeguard employees.

(b) *Underground installations.*

(b)(1) The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation.

(b)(2) Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used.

(b)(3) When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means.

(b)(4) While the excavation is open, underground installations shall be protected, supported or removed as necessary to safeguard employees.

(c)(2) *Means of egress from trench excavations.* A stairway, ladder, ramp or other safe means of egress shall be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

(d) Exposure to vehicular traffic. Employees exposed to public vehicular traffic shall be provided with, and shall wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

(e) Exposure to falling loads. No employee shall be permitted underneath loads handled by lifting or digging equipment. Employees shall be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

(f) Warning system for mobile equipment. When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system shall be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

(h) Protection from hazards associated with water accumulation.

(h)(1) Employees shall not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

(h)(2) If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations shall be monitored by a competent person to ensure proper operation.

(h)(3) If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person and compliance with paragraphs (h)(1) and (h)(2) of this section.

(i) Stability of adjacent structures.

(i)(1) Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning shall be provided to ensure the stability of such structures for the protection of employees.

(i)(2) Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees shall not be permitted except when:

(i)(2)(i) A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

(i)(2)(ii) The excavation is in stable rock; or

(i)(2)(iii) A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

(i)(2)(iv) A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

(i)(3) Sidewalks, pavements and appurtenant structure shall not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

(j) *Protection of employees from loose rock or soil.*

(j)(1) Adequate protection shall be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection shall consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

(j)(2) Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

(k) *Inspections.*

(k)(1) Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated.

(k)(2) Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

(l) Walkways shall be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) shall be provided where walkways are 6 feet (1.8 m) or more above lower levels.

§ 1926.652 - Requirements for protective systems.

(a) *Protection of employees in excavations.*

(a)(1) Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with paragraph (b) or (c) of this section except when:

(a)(1)(i) Excavations are made entirely in stable rock; or

(a)(1)(ii) Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

(a)(2) Protective systems shall have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

(b) *Design of sloping and benching systems.* The slopes and configurations of sloping and benching systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (b)(1); or, in the alternative, paragraph (b)(2); or, in the alternative, paragraph (b)(3); or, in the alternative, paragraph (b)(4), as follows:

(b)(1) Option (1) - Allowable configurations and slopes.

(b)(1)(i) Excavations shall be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

(b)(1)(ii) Slopes specified in paragraph (b)(1)(i) of this section, shall be excavated to form configurations that are in accordance with the slopes shown for Type C soil in Appendix B to this subpart.

(b)(2) Option (2) - Determination of slopes and configurations using Appendices A and B. Maximum allowable slopes, and allowable configurations for sloping and benching systems, shall be determined in accordance with the conditions and requirements set forth in appendices A and B to this subpart.

(b)(4) Option (4) - Design by a registered professional engineer.

(b)(4)(i) Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) under paragraph (b) of this section shall be approved by a registered professional engineer.

(b)(4)(ii) Designs shall be in written form and shall include at least the following:

(b)(4)(ii)(A) The magnitude of the slopes that were determined to be safe for the particular project;

(b)(4)(ii)(B) The configurations that were determined to be safe for the particular project;

(b)(4)(ii)(C) The identity of the registered professional engineer approving the design.

(b)(4)(iii) At least one copy of the design shall be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy shall be made available to the Secretary upon request.

(c) *Design of support systems, shield systems, and other protective systems.* Designs of support systems, shield systems, and other protective systems shall be selected and constructed by the employer or his designee and shall be in accordance with the requirements of paragraph (c)(2) as follows:

(c)(2) Option (2) - Designs Using Manufacturer's Tabulated Data.

(c)(2)(i) Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

(c)(2)(ii) Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer shall only be allowed after the manufacturer issues specific written approval.

(c)(2)(iii) Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations shall be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy shall be made available to the Secretary upon request.

(e) *Installation and removal of support-*

(e)(1) *General.*

(e)(1)(i) Members of support systems shall be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

(e)(1)(ii) Support systems shall be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

(e)(1)(iii) Individual members of support systems shall not be subjected to loads exceeding those which those members were designed to withstand.

(e)(1)(iv) Before temporary removal of individual members begins, additional precautions shall be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

(e)(1)(v) Removal shall begin at, and progress from, the bottom of the excavation. Members shall be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

(e)(1)(vi) Backfilling shall progress together with the removal of support systems from excavations.

(e)(2) *Additional requirements for support systems for trench excavations.*

(e)(2)(i) Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system shall be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

(e)(2)(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems.*

(g)(1) *General.*

(g)(1)(i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(g)(1)(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(g)(1)(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(g)(1)(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(g)(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Subpart P Appendix A - Soil Classification

(a) *Scope and application.*

(a)(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(a)(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following; American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System; The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or shear vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if: (i) The soil is fissured; or (ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or (iii) The soil has been previously disturbed; or (iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or (v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means: (i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or (ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam. (iii) Previously disturbed soils except those which would otherwise be classed as Type C soil. (iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or (v) Dry rock that is not stable; or (vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means: (i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48kPa) or less; or (ii) Granular soils including gravel, sand, and loamy sand; or (iii) Submerged soil or soil from which water is freely seeping; or (iv) Submerged rock that is not stable, or (v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) Requirements

(c)(1) Classification of soil and rock deposits. Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(c)(2) Basis of classification. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(c)(3) Visual and manual analyses. The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(c)(4) Layered systems. In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(c)(5) Reclassification. If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) Acceptable visual and manual tests.-

(d)(1) Visual tests. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(d)(1)(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(d)(1)(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(d)(1)(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(d)(1)(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(d)(1)(v) Observed the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(d)(1)(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(d)(1)(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(d)(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(d)(2)(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(d)(2)(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(d)(2)(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488 - "Standard Recommended Practice for Description of Soils (Visual - Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(d)(2)(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(d)(2)(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(d)(2)(v)(A) If the sample develops cracks as it dries, significant fissures are indicated.

(d)(2)(v)(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

(d)(2)(v)(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Subpart P Appendix B - Sloping and Benching

(a) Scope and application. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in 1926.652(b)(2).

(b) Definitions.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) Requirements -

(c)(1) Soil classification. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(c)(2) Maximum allowable slope. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(c)(3) Actual slope.

(c)(3)(i) The actual slope shall not be steeper than the maximum allowable slope.

(c)(3)(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least 1/2 horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope.

(c)(3)(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with 1926.651(i).

(c)(4) Configurations. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

**TABLE B-1.
Maximum Allowable Slopes**

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) ¹ FOR EXCAVATIONS LESS THAN 20 FEET DEEP ³
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A ²	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

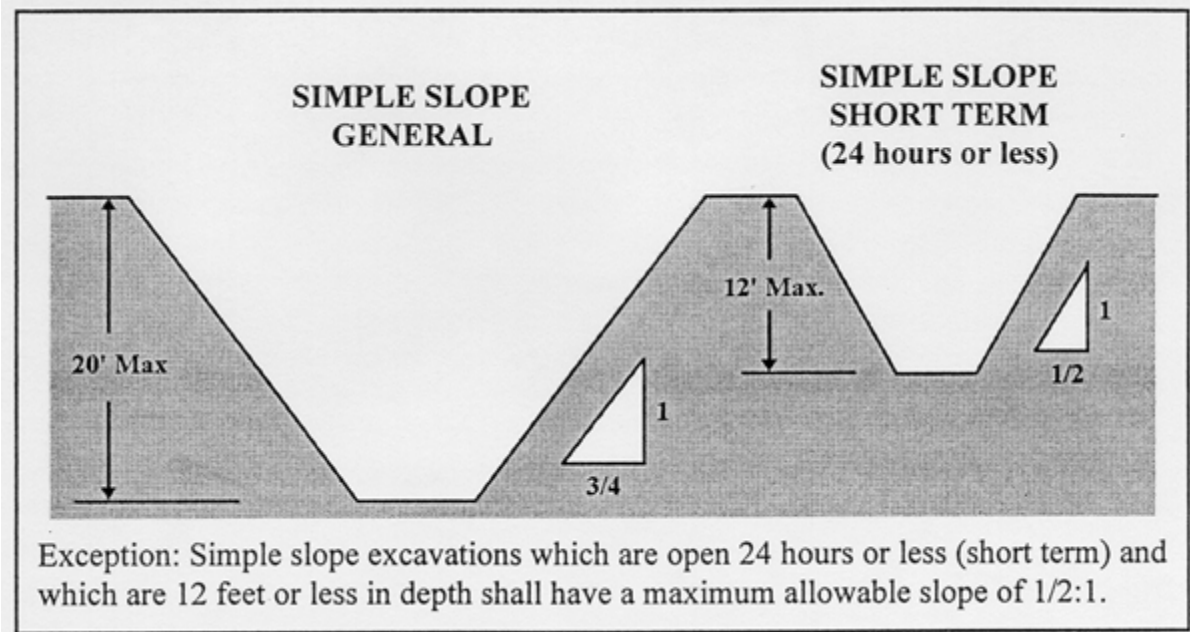
² A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53 degrees).

³ Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

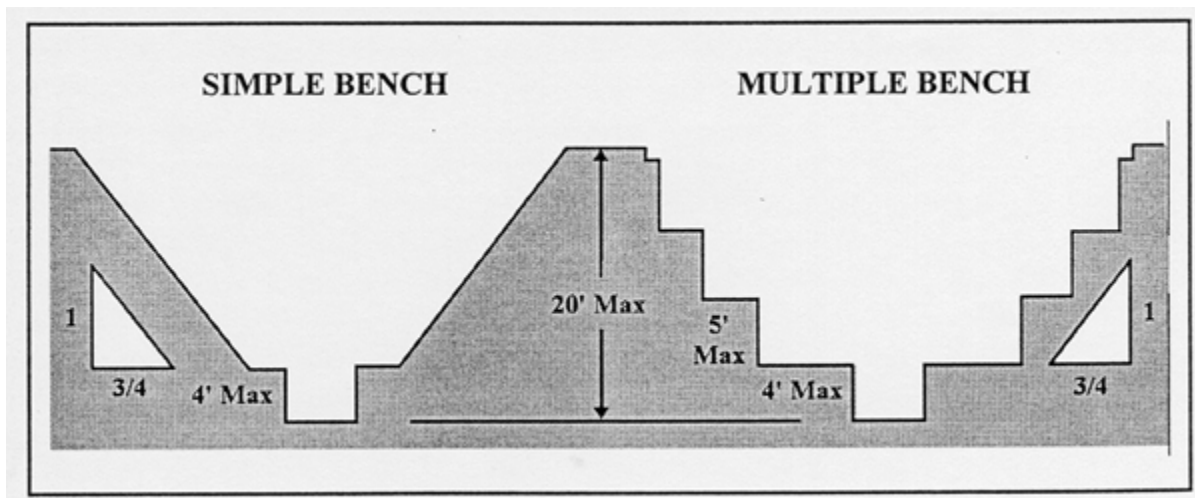
Figure B-1 - Slope Configurations
(All slopes stated below are in the horizontal to vertical ratio)

B-1.1 Excavations made in Type A soil.

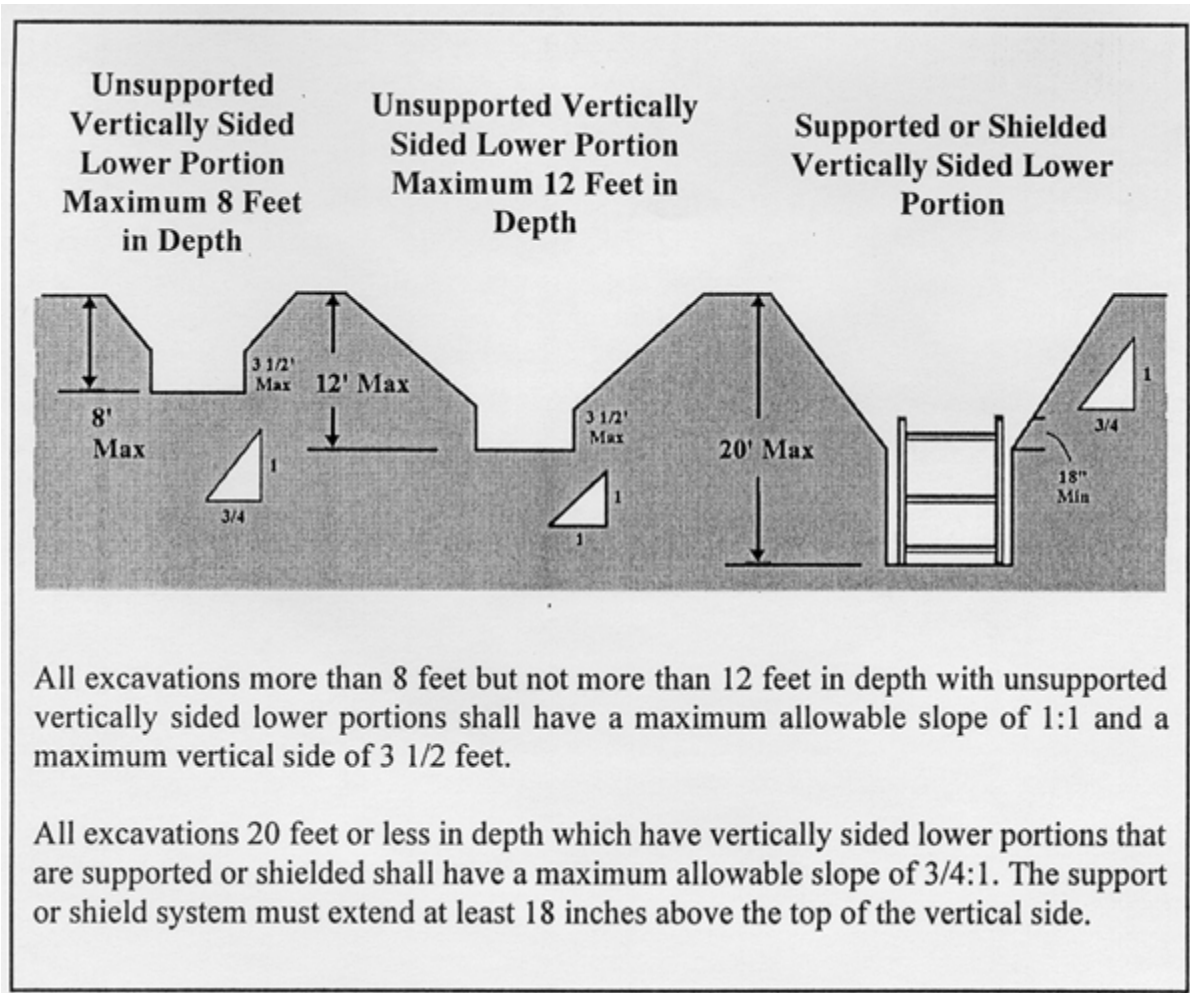
1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of 3/4:1.



2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:



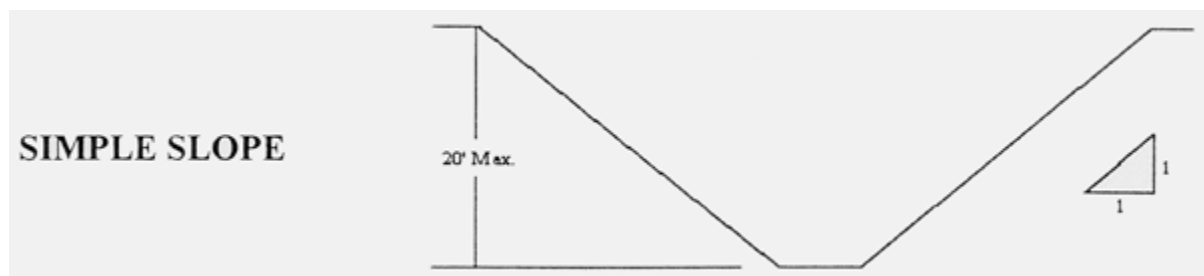
3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3 1/2 feet.



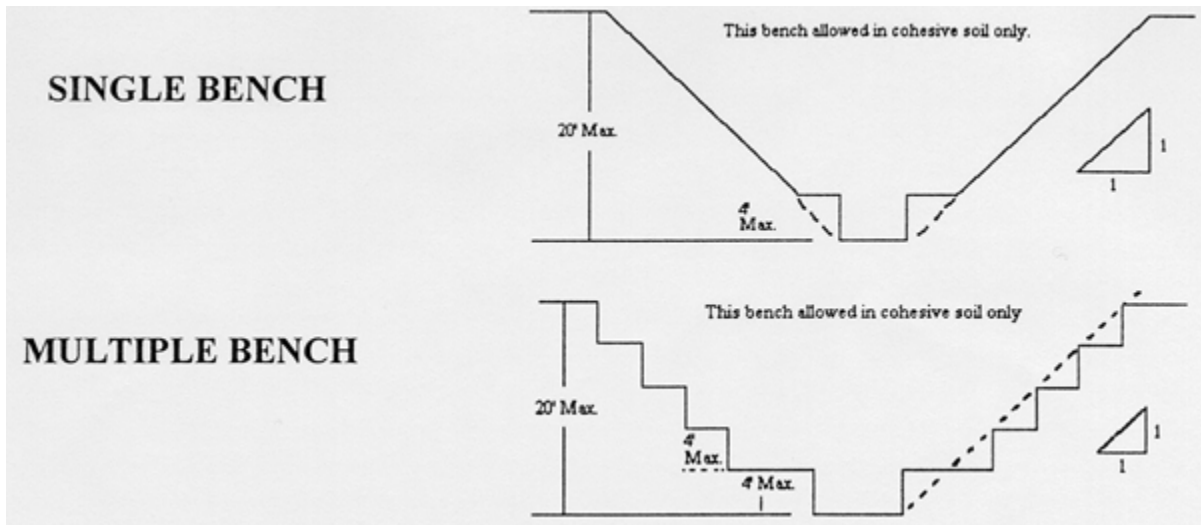
4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under 1926.652(b).

B-1.2 Excavations made in Type B soil.

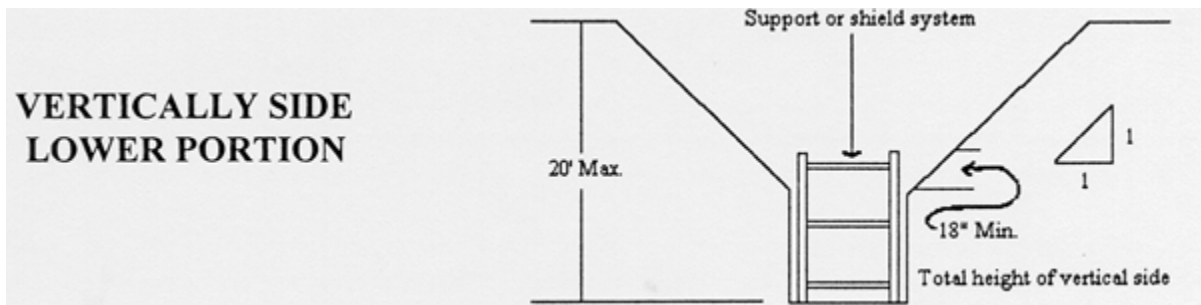
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.



2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:



3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

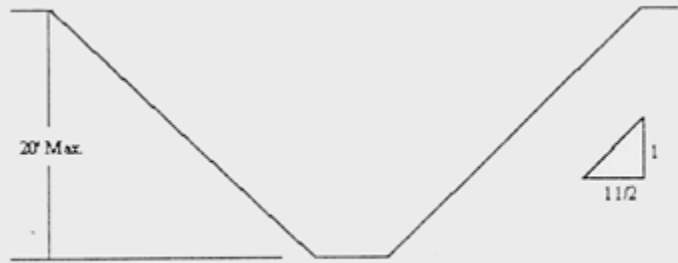


4. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

B-1.3 Excavations made in Type C soil.

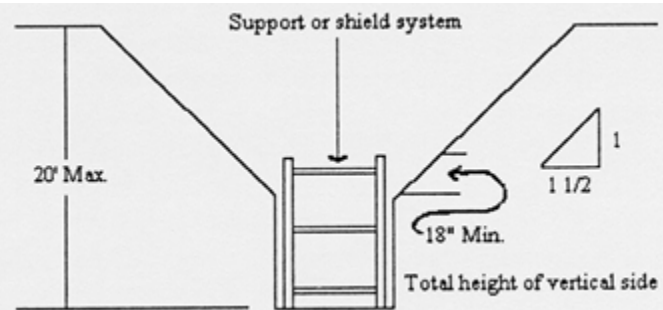
1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1 1/2:1.

SIMPLE SLOPE



2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1 1/2:1.

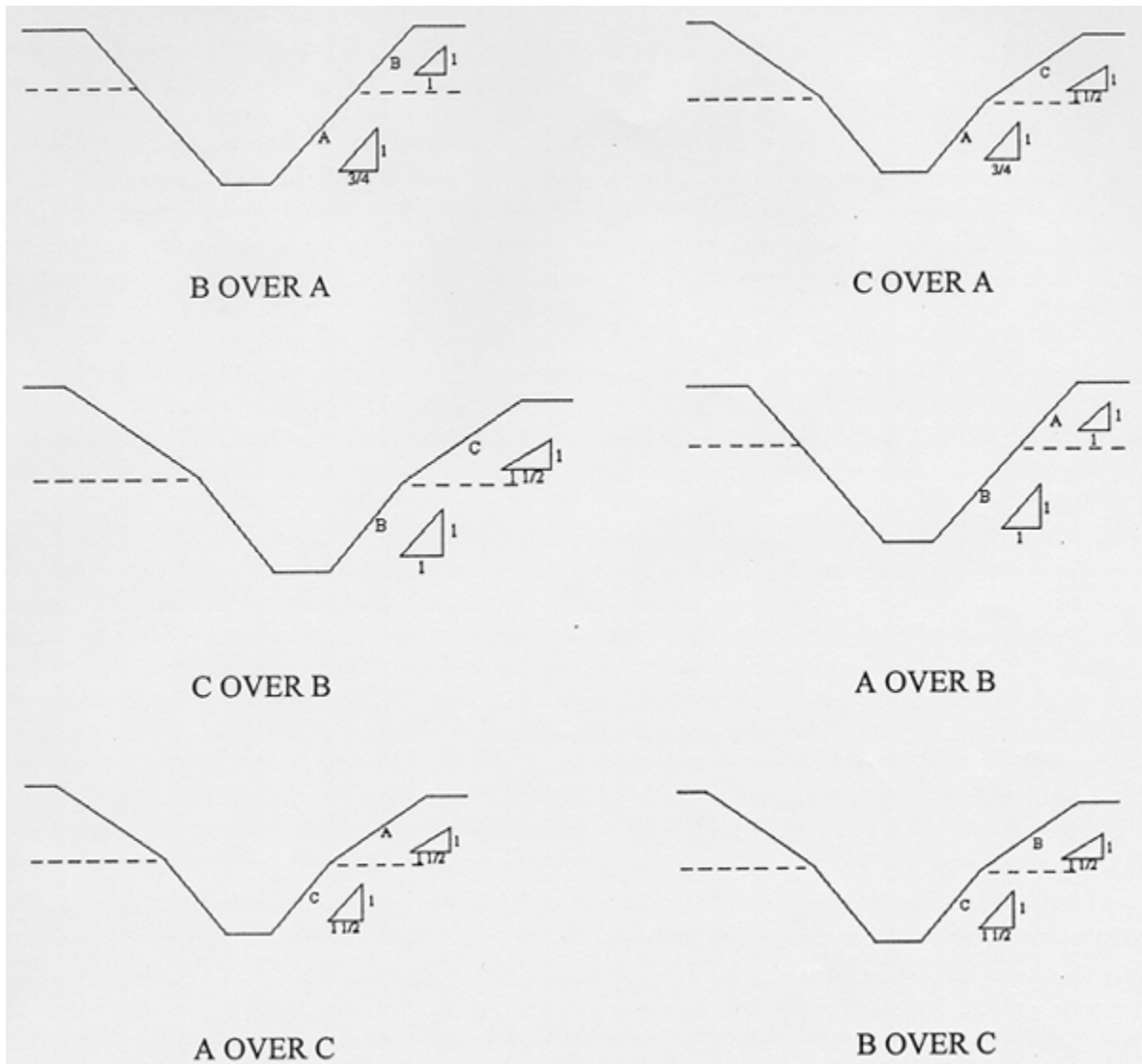
VERTICAL SIDED LOWER PORTION



3. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

B-1.4 Excavations made in Layered Soils

1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



2. All other sloped excavations shall be in accordance with the other options permitted in 1926.652(b).

ATTACHMENT XI

TETRA TECH DECONTAMINATION OF FIELD EQUIPMENT AND WASTE HANDLING STANDARD OPERATING PROCEDURE



TETRA TECH NUS, INC.

STANDARD OPERATING PROCEDURES

Number	SA-7.1	Page	1 of 8
Effective Date	09/03	Revision	3
Applicability	Tetra Tech NUS, Inc.		
Prepared	Earth Sciences Department		
Approved	D. Senovich <i>ds</i>		

Subject DECONTAMINATION OF FIELD EQUIPMENT

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1.0 PURPOSE

Decontamination is the process of removing and/or neutralizing site contaminants that have contacted and/or accumulated on equipment. The objective/purpose of this SOP is intended to protect site personnel, general public, and the sample integrity through the prevention of cross contamination onto unaffected persons or areas. It is further intended through this procedure to provide guidelines regarding the appropriate procedures to be followed when decontaminating drilling equipment, monitoring well materials, chemical sampling equipment and field analytical equipment.

2.0 SCOPE

This procedure applies to all equipment including drilling equipment, heavy equipment, monitoring well materials, as well as chemical sampling and field analytical equipment decontamination that may be used to provide access/acquire environmental samples. Where technologically and economically feasible, single use sealed disposable equipment will be employed to minimize the potential for cross contamination. This procedure also provides general reference information on the control of contaminated materials.

3.0 GLOSSARY

Acid - For decontamination of equipment when sampling for trace levels of inorganics, a 10% solution of nitric acid in deionized water should be used. Due to the leaching ability of nitric acid, it should not be used on stainless steel.

Alconox/Liquinox - A brand of phosphate-free laboratory-grade detergent.

Decontamination Solution - Is a solution selected/identified within the Health and Safety Plan or Project-Specific Quality Assurance Plan. The solution is selected and employed as directed by the project chemist/health and safety professional.

Deionized Water (DI) - Deionized water is tap water that has been treated by passing through a standard deionizing resin column. This water may also pass through additional filtering media to attain various levels of analyte-free status. The DI water should meet CAP and NCCLS specifications for reagent grade, Type I water.

Potable Water - Tap water used from any municipal water treatment system. Use of an untreated potable water supply is not an acceptable substitute for tap water.

Pressure Washing - Employs high pressure pumps and nozzle configuration to create a high pressure spray of potable water. High pressure spray is employed to remove solids.

Solvent - The solvent of choice is pesticide-grade Isopropanol. Use of other solvents (methanol, acetone, pesticide-grade hexane, or petroleum ether) may be required for particular projects or for a particular purpose (e.g. for the removal of concentrated waste) and must be justified in the project planning documents. As an example, it may be necessary to use hexane when analyzing for trace levels of pesticides, PCBs, or fuels. In addition, because many of these solvents are not miscible in water, the equipment should be air dried prior to use. Solvents should not be used on PVC equipment or well construction materials.

Steam Pressure Washing - This method employs a high pressure spray of heated potable water. This method through the application of heat provides for the removal of various organic/inorganic compounds.

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4.0 RESPONSIBILITIES

Project Manager - Responsible for ensuring that all field activities are conducted in accordance with approved project plan(s) requirements.

Field Operations Leader (FOL) - Responsible for the onsite verification that all field activities are performed in compliance with approved Standards Operating Procedures or as otherwise dictated by the approved project plan(s).

Site Health and Safety Officer (SHSO) - The SHSO exercises shared responsibility with the FOL concerning decontamination effectiveness. All equipment arriving on-site (as part of the equipment inspection), leaving the site, moving between locations are required to go through a decontamination evaluation. This is accomplished through visual examination and/or instrument screening to determine the effectiveness of the decontamination process. Failure to meet these objectives are sufficient to restrict equipment from entering the site/exiting the site/ or moving to a new location on the site until the objectives are successfully completed.

5.0 PROCEDURES

The process of decontamination is accomplished through the removal of contaminants, neutralization of contaminants, or the isolation of contaminants. In order to accomplish this activity a level of preparation is required. This includes site preparation, equipment selection, and evaluation of the process. Site contaminant types, concentrations, media types, are primary drivers in the selection of the types of decontamination as well as where it will be conducted. For purposes of this SOP discussion will be provided concerning general environmental investigation procedures.

The decontamination processes are typically employed at:

- Temporary Decontamination Pads/Facilities
- Sample Locations
- Centralized Decontamination Pad/Facilities
- Combination of some or all of the above

The following discussion represents recommended site preparation in support of the decontamination process.

5.1 Decontamination Design/Constructions Considerations

5.1.1 Temporary Decontamination Pads

Temporary decontamination pads are constructed at satellite locations in support of temporary work sites. These structures are generally constructed to support the decontamination of heavy equipment such as drill rigs and earth moving equipment but can be employed for smaller articles.

The purpose of the decontamination pad is to contain wash waters and potentially contaminated soils generated during decontamination procedures. Therefore, construction of these pads should take into account the following considerations

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- Site Location – The site selected should be within a reasonable distance from the work site but should avoid:
 - Pedestrian/Vehicle thoroughfares
 - Areas where control/custody cannot be maintained
 - Areas where a potential releases may be compounded through access to storm water transport systems, streams or other potentially sensitive areas.
 - Areas potentially contaminated.
- Pad – The pad should be constructed to provide the following characteristics
 - Size – The size of the pad should be sufficient to accept the equipment to be decontaminated as well as permitting free movement around the equipment by the personnel conducting the decontamination.
 - Slope – An adequate slope will be constructed to permit the collection of the water and potentially contaminated soils within a trough or sump constructed at one end. The collection point for wash waters should be of adequate distance that the decontamination workers do not have to walk through the wash waters while completing their tasks.
 - Sidewalls – The sidewalls should be a minimum of 6-inches in height to provide adequate containment for wash waters and soils. If splash represents a potential problem, splash guards should be constructed to control overspray. Sidewalls maybe constructed of wood, inflatables, sand bags, etc. to permit containment.
 - Liner – Depending on the types of equipment and the decontamination method the liner should be of sufficient thickness to provide a puncture resistant barrier between the decontamination operation and the unprotected environment. Care should be taken to examine the surface area prior to placing the liner to remove sharp articles (sticks, stones, debris) that could puncture the liner. Liners are intended to form an impermeable barrier. The thickness may vary from a minimum recommended thickness of 10 mil to 30 mil. Achieving the desired thickness maybe achieved through layering lighter constructed materials. It should be noted that various materials (rubber, polyethylene sheeting) become slippery when wet. To minimize this potential hazard associated with a sloped liner a light coating of sand maybe applied to provide traction as necessary.
 - Wash/drying Racks – Auger flights, drill/drive rods require racks positioned off of the ground to permit these articles to be washed, drained, and dried while secured from falling during this process. A minimum ground clearance of 2-feet is recommended.
 - Maintenance – The work area should be periodically cleared of standing water, soils, and debris. This action will aid in eliminating slip, trip, and fall hazards. In addition, these articles will reduce potential backsplash and cross contamination. Hoses should be gathered when not in use to eliminate potential tripping hazards.

5.1.2 Decontamination Activities at Drill Rigs/DPT Units

During subsurface sampling activities including drilling and direct push activities decontamination of drive rods, Macro Core Samplers, split spoons, etc. are typically conducted at an area adjacent to the operation. Decontamination is generally accomplished using a soap/water wash and rinse utilizing buckets and brushes. This area requires sufficient preparation to accomplish the decontamination objectives.

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Buckets shall be placed within mortar tubs or similar secondary containment tubs to prevent splash and spills from reaching unprotected media. Drying racks will be employed as directed for temporary pads to permit parts to dry and be evaluated prior to use/re-use.

5.1.3 Decontamination Activities at Remote Sample Locations

When sampling at remote locations sampling devices such as trowels, pumps/tubing should be evacuated of potentially contaminated media to the extent possible. This equipment should be wrapped in plastic for transport to the temporary/centralized decontamination location for final cleaning and disposition.

5.2 Equipment Decontamination Procedures

The following represents procedures to be employed for the decontamination of equipment that may have contacted and/or accumulated contamination through site investigation activities.

5.2.1 Monitoring Well Sampling Equipment

5.2.1.1 Groundwater sampling pumps – This includes pumps inserted into the monitoring well such as Bladder pumps, Whale pumps, Redi-Flo, reusable bailers, etc.

- 1) Evacuate to the extent possible, any purge water within the pump.
- 2) Scrub using soap and water and/or steam clean the outside of the pump and tubing, where applicable.
- 3) Insert the pump and tubing into a clean container of soapy water. Pump a sufficient amount of soapy water through the pump to flush any residual purge water. Once flushed, circulate soapy water through the pump to ensure the internal components are thoroughly flushed.
- 4) Remove the pump and tubing from the container, rinse external components using tap water. Insert the pump and tubing into a clean container of tap water. Pump a sufficient amount of tap water through the pump to evacuate all of the soapy water (until clear).
- 5) Rinse equipment with pesticide grade isopropanol
- 6) Repeat item #4 using deionized water through the hose to flush out the tap water and solvent residue as applicable .
- 7) Drain residual deionized water to the extent possible, allow components to air dry.
- 8) Wrap pump in aluminum foil or a clear clean plastic bag for storage.

5.2.1.2 Electronic Water Level Indicators/Sounders/Tapes

During water level measurements, rinsing with the extracted tape and probe with deionized water and wiping the surface of the extracted tape is acceptable. However, periodic full decontamination should be conducted as indicated below.

* - The solvent should be employed when samples contain oil, grease, PAHs, PCBs, and other hard to remove materials. If these are not of primary concern, the solvent step may be omitted. In addition, do not rinse PE, PVC, and associated tubing with solvents.

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- 1) Wash with soap and water
- 2) Rinse with tap water
- 3) Rinse with deionized water

Note: In situations where oil, grease, free product, other hard to remove materials are encountered probes and exposed tapes should be washed in hot soapy water.

5.2.1.3 Miscellaneous Equipment

Miscellaneous equipment including analytical equipment (water quality testing equipment) should be cleaned per manufacturer's instructions. This generally includes wiping down the sensor housing and rinsing with tap and deionized water.

Coolers/Shipping Containers employed to ship samples are received from the lab in a variety of conditions from marginal to extremely poor. Coolers should be evaluated prior to use for

- Structural integrity – Coolers missing handles or having breaks within the outer housing should be removed and not used. Notify the laboratory that the risk of shipping samples will not be attempted and request a replacement unit.
- Cleanliness – As per protocol only volatile organic samples are accompanied by a trip blank. If a cooler's cleanliness is in question (visibly dirty/stained) or associated with noticeable odors it should be decontaminated prior to use.

- 1) Wash with soap and water
- 2) Rinse with tap water
- 3) Dry

If these measures fail to clean the cooler to an acceptable level, remove the unit from use as a shipping container and notify the laboratory to provide a replacement unit.

5.2.2 **Down-Hole Drilling Equipment**

This includes any portion of the drill rig that is over the borehole including auger flights, drill stems, rods, and associated tooling that would extend over the borehole. This procedure is to be employed prior to initiating the drilling/sampling activity, then between locations.

- 1) Remove all soils to the extent possible using shovels, scrapers, etc. to remove loose soils.
- 2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.
- 3) Rinse with tap water.
- 4) Rinse equipment with pesticide grade isopropanol
- 5) To the extent possible allow components to air dry.
- 6) Wrap or cover equipment in clear plastic until it is time to be used.

5.2.3 **Soil/Sediment Sampling Equipment**

This consists of soil sampling equipment including but not limited to hand augers, stainless steel trowels/spoons, bowls, dredges, scoops, split spoons, Macro Core samplers, etc.

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- 1) Remove all soils to the extent possible.
- 2) Through a combination of scrubbing using soap and water and/or steam cleaning remove visible dirt/soils.
- 3) Rinse with tap water.
- 4) Rinse equipment with pesticide grade isopropanol
- 5) Rinse with deionized water
- 6) To the extent possible allow components to air dry.
- 7) If the device is to be used immediately, screen with a PID/FID to insure all solvents (if they were used) and trace contaminants have been adequately removed.
- 8) Once these devices have been dried wrap in aluminum foil for storage until it is time to be used.

5.3 Contact Waste/Materials

During the course of field investigations disposable/single use equipment becomes contaminated. These items include tubing, trowels, PPE (gloves, overboots, splash suits, etc.) broken sample containers.

With the exception of the broken glass, single use articles should be cleaned (washed and rinsed) of visible materials and disposed of as normal refuse. The exception to this rule is that extremely soiled materials that cannot be cleaned should be containerized for disposal in accordance with applicable federal state and local regulations.

5.3.1 **Decontamination Solutions**

All waste decontamination solutions and rinses must be assumed to contain the hazardous chemicals associated with the site unless there are analytical or other data to the contrary. The waste solution volumes could vary from a few gallons to several hundred gallons in cases where large equipment required cleaning.

Containerized waste rinse solutions are best stored in 55-gallon drums (or equivalent containers) that can be sealed until ultimate disposal at an approved facility. These containers must be appropriately labeled.

5.4 Decontamination Evaluation

Determining the effectiveness of the decontamination process will be accomplished in the following manner

- Visual Evaluation – A visual evaluation will be conducted to insure the removal of particulate matter. This will be done to insure that the washing/rinsing process is working as intended.
- Instrument Screening – A PID and/or an FID should be used to evaluate the presence of the contaminants or solvents used in the cleaning process. The air intake of the instrument should be passed over the article to be evaluated. A positive detection requires a repeat the decontamination process. It should be noted that the instrument scan is only viable if the contaminants are detectable within the instruments capabilities.

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- Rinsate Blanks – It is recommended that Rinsate samples be collected to
 - Evaluate the decontamination procedure representing different equipment applications (pumps versus drilling equipment) and different decontamination applications.
 - Single use disposable equipment – The number of samples should represent different types of equipment as well as different Lot Numbers of single use articles.

The collection and the frequency of collection of rinsate samples are as follows:

- Per decontamination method
- Per disposable article/Batch number of disposable articles

It is recommended that an initial rinsate sample be collected early in the project to ensure that the decontamination process is functioning properly and in an effort to avoid using a contaminated batch of single use articles. It is recommended that a follow up sample be collected during the execution of the project to insure those conditions do not change. Lastly, rinsate samples collection may be driven by types of and/or contaminant levels. Hard to remove contaminants, oils/greases, some PAHs/PCBs, etc. may also support the collection of additional rinsates due to the obvious challenges to the decontamination process. This is a field consideration to be determined by the FOL.

ATTACHMENT XII

OSHA POSTER

Job Safety and Health

It's the law!

EMPLOYEES:

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

**This free poster available from OSHA –
The Best Resource for Safety and Health**



**Occupational Safety
and Health Administration**
U.S. Department of Labor



Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

1-800-321-OSHA
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OSHA 3165-12-06R

APPENDIX B — WASTE MANAGEMENT PLAN