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REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
PENINSULA BOULEVARD GROUNDWATER PLUME RI/FS
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT
NASSAU COUNTY, NEW YORK

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Table of Contents

Tables

Figures

Appendices

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment
BTAG	Biological Technical Assistance Group
CDI	Chronic Daily Intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CIP	Community Involvement Plan
CLP	Contract Laboratory Program
CMT	Continuous Multichannel Tubing
COC	Chain-of-Custody
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Ecological Concern
CPI	Characters per inch
CSF	Cancer Slope Factor
CT	Central Tendency
DER	Data Evaluation Report
DESA	Division of Environmental Science and Assessment
DQOs	Data Quality Objectives
DQCR	Daily Quality Control Reports
EFH	Exposure Factors Handbook
ELCR	Excess Lifetime Cancer Risks
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentration
EPIC	Environmental Photographic Interpretation Center
ERAGS	Ecological Risk Assessment Guidance for Superfund
FASTAC	Field and Analytical Services Teaming Advisory Committee
FID	Flame Ionization Detector
fpd	feet per day
FRI	Focused Remedial Investigation
FS	Feasibility Study
GIS	Geographic Information System
GPS	Global Positioning System
GRA	General Response Action
GZA	GZA Environmental of New York
HASP	Health and Safety Plan
HDR	Henningson, Durham & Richardson Architecture & Engineering, P.C. in association with HDR Engineering, Inc.
HDPE	High Density Polyethylene
HEAST	Health Effects Assessment Summary Table
HI	Hazard Index

HQ	Hazard Quotient
HRSP	Hazard Ranking System Package
ID	Inner Diameter
IDW	Investigation Derived Waste
IRIS	Integrated Risk Information System
JFK	John F. Kennedy International Airport
LDP	Locational Data Policy
LIWC	Long Island Water Corporation
LOE	Level-of-Effort
MDC	Maximum Detected Concentration
mg/kg	milligrams per kilogram
msl	mean sea level
NAD	North American Datum
NAVD	North American Vertical Datum
NCDH	Nassau County Department of Health
NCP	National Contingency Plan
ND	Non detect
NPL	National Priorities List
NYSDEC	New York State Department of Environmental Conservation
OD	Outer Diameter
ODC	Other Direct Cost
O&M	Operation and Maintenance
OSWER	Solid Waste and Emergency Response
PAR	Pathways Analysis Report
PCE	Tetrachloroethene
PID	Photoionization Detector
PP	Proposed Plan
ppb	parts per billion
ppm	parts per million
PPRTV	Provisional Peer Reviewed Toxicity Values
PRAP	Proposed Remedial Action Plan
PRGs	Preliminary Remediation Goals
PVC	Polyvinyl Chloride
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Check
RAGS	Risk Assessment Guidelines for Superfund
RAO	Remedial Action Objective
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RS	Responsiveness Summary
RSCC	Regional Sample Control Center
SCM	Site Conceptual Model
SLERA	Screening Level Ecological Risk Assessment
SMDP	Scientific Management Decision Point

SOPs	Standard Operating Procedures
SOW	Statement of Work
SVIS	Soil Vapor Intrusion Sampling
SVOC	Semi-Volatile Organic Compound
TAMS	TAMS Consultants, Inc.
TAL	Target Analyte List
TBC	To Be Considered
TCE	Trichloroethene
TtFW	Tetra Tech FW, Inc.
TtEC	Tetra Tech EC, Inc.
UCL	Upper Confidence Limit
ug/L	microgram per Liter
ug/kg	micrograms per kilogram
USCS	Unified Soil Classification System
UFP	Uniform Federal Policy
UGA	Upper Glacial Aquifer
UST	Underground Storage Tank
USGS	United States Geological Survey
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound
WMP	Waste Management Plan
WA	Work Assignment
WACR	Work Assignment Closeout Report
WAM	Work Assignment Manager
WP	Work Plan
ybp	years before present

1 Introduction

This Work Plan was prepared on behalf of the United States Environmental Protection Agency (EPA) by Henningson, Durham & Richardson Architecture & Engineering, P.C. in association with HDR Engineering, Inc. (HDR) to provide a scope of work for the Remedial Investigation/Feasibility Study (RI/FS) for the Peninsula Boulevard Superfund Site (the Site) in Nassau County, New York. This Work Plan with proposed costs and Level of Effort was based upon the May 28, 2009 EPA Statement of Work (SOW) and discussions with the EPA during the scoping meeting held on July 8, 2009, a technical meeting held on August 5, 2009, a conference call of August 10, 2009, and final comments received in January 2010. The RI/FS is being performed under Work Assignment Number 002-RICO-02TV, under the EPA RAC II Contract Number EP-W-09-009.

The RI/FS tasks provided in the SOW are outlined and described in this Work Plan. Activities for the RI/FS will include a review of the background materials; oversight of the installation of six new monitoring wells; collection of groundwater samples at the existing 20 wells; collection of groundwater and soil samples at the new monitoring wells; data evaluation; conducting risk assessments and establishing risk reduction goals; identifying and screening remedial alternatives; and preparation of RI and FS deliverables. In accordance with the Work Assignment (WA), the period of performance will be a 26-month time frame from May 28, 2009 to June 1, 2011. An anticipated RI/FS project schedule (see Figure 1) and deliverables schedule (see Table 1) are also being submitted with this Work Plan (WP). A draft Quality Assurance Project Plan (QAPP) and a draft project-specific Health and Safety Plan (HASP) have been submitted to EPA. A Work Plan Budget Estimate was submitted to EPA under separate cover.

It should be noted that the assumptions and approaches for the tasks described in this WP are based on prior investigatory work at the Peninsula Boulevard site by Tetra Tech FW, Inc (TtFW) under EPA RAC II Contract Number 68-W-98-214, and other site information. A summary of the work conducted by TtFW is described below in Section 2. At the direction of EPA, and as detailed in the May 28, 2009 SOW, HDR has prepared this WP to attempt to complete the investigatory activities at the site and advance the RI/FS.

The primary objectives of the RI/FS include:

- Review and assess historic investigatory work at the site conducted by and on behalf of EPA (and other entities, as available), and develop and implement an approach to gather sufficient data to complete the Remedial Investigation;
- Identify potential sources of PCE that have impacted subsurface media at the site, and further develop the Site Conceptual Model (SCM) for subsurface contamination;
- Assess potential current and future human health risks posed by impacted media (groundwater, soil, sediment, surface water, soil gas);
- Conduct a screening-level ecological risk assessment (SLERA) to determine current potential for ecological risk, and scope for a baseline ecological risk assessment if warranted;
- Identify appropriate remedial alternatives for the impacted media described in the RI to appropriately minimize risks to human health and the environment, and to support a Record of Decision (ROD);
- Consider elements of Green Remediation and sustainable practices throughout the RI/FS process, and document efforts and observations to EPA; and
- Finalize RI/FS deliverables as prescribed in the EPA SOW.

If new or unique contaminant conditions or hydrogeological information, potential source areas, and/or findings of significance that may warrant additional investigatory work are identified during the RI/FS activities described

in the WP, the tasks in this WP may be amended with EPA's written approval. At such decision points, HDR will prepare a Technical Memorandum to describe the site findings / conditions and formulate recommendations to EPA. No work beyond that described in EPA's SOW or this WP will be initiated prior to obtaining EPA approval.

1.1 Purpose

At the direction of EPA, HDR has prepared this WP to describe the technical approaches to conduct the following tasks: complete the investigatory activities at the site; develop the SCM; assess potential exposure pathways and risks relevant to human health and the environment; and identify and evaluate appropriate remedial alternatives to eliminate, reduce, or control risks that are identified.

1.2 Background

As noted in a ROD issued by the New York State Department of Environmental Conservation (NYSDEC) in March 2003, the operations of the former Grove Cleaners at 1274 Peninsula Boulevard from 1987 – 1992 resulted in the disposal of hazardous wastes to the environment, including tetrachloroethylene (PCE) and trichloroethylene (TCE). The Nassau County Department of Health (NCDH) cited Grove Cleaners in March 1991 for discharging hazardous waste into on-site dry wells. Tetrachloroethene (PCE) was detected in soil and sludge samples collected at the site, and in other media at and near the former Grove Cleaners site. The NYSDEC became involved in 1992 and classified the Grove Cleaners site as a Class 2 Inactive Hazardous Waste Disposal Site in March 1993 (USEPA NPL website, 2004).

A series of investigations and removal actions from 1991 to 1999 (on behalf of the property owner, and later on behalf of NYSDEC) resulted in the completion of a Focused Remedial Investigation (FRI) by TAMS Consultants, Inc. (TAMS) and GZA GeoEnvironmental of New York (GZA). The results of the FRI indicated an extensive plume of groundwater located north and south of Peninsula Boulevard, primarily impacted by PCE. In addition, the results of the FRI suggested the potential for additional source areas other than the former Grove Cleaners site (TAMS/GZA, 2002).

A No Further Action remedy was selected by NYSDEC for the former Grove Cleaners site, following the implementation of interim remedial measures (IRMs). The EPA assumed responsibility for the (larger) Peninsula Boulevard Groundwater Plume Site in September 2002. A Hazard Ranking System Package (HRSP) was prepared in March 2004, and the Site scored 50 of a possible 100 points, placing the Site on the National Priorities List (NPL) in August 2004.

TtFW, under EPA Contract Number 68-W-98-214, conducted work on the Peninsula Boulevard Groundwater Plume Site project that included, but was not necessary limited to: development and finalization of RI/FS Work Plan (final document dated April 2005); implementation of site characterization work including environmental sampling and hydrogeological analyses, and associated data interpretation; submittal of a Data Evaluation Report (October 2008).

1.3 Site Location and Description

The Site consists of the area within and around the groundwater plume identified during a series of site investigations (and some limited removal / IRM activities; former Grove Cleaners site) conducted from 1991 to 2008. According to information reported by TtFW, the plume extends approximately 3,250 feet northwest to southeast and is approximately 1,200 feet wide at its widest point. The Site is located in The Village of Hewlett (Town of Hempstead, Nassau County, New York) which is bordered by East Rockaway and Hewlett Bay Park to

the east, Valley Stream and Lynbrook to the north, Woodmere to the west, and Woodbury and Cedarhurst to the south. John F. Kennedy International Airport is located approximately three miles to the west of the Site. The area consists of a mix of commercial and residential property, with the majority of the commercial property along Mill Road, Peninsula Boulevard, Broadway, and West Broadway. The southern two-thirds of the plume exists south of Peninsula Boulevard, within a residential neighborhood. The northern one-third of the plume occurs north of Peninsula Boulevard, where commercial and municipal properties are located (TtEC DER, 2008). A Site Location Map is provided as Figure 2.

Long Island American Water (LIAW) operates a well field (Plant 5 Well Field) on property that exists within approximately 1,000 feet of the northern extent of the study area. LIAW has reportedly been monitoring and pre-treating groundwater (via air stripping to remove VOCs) since 1991, and continues to maintain monitoring and pre-treatment activities. Portions of Motts Creek, Doxey Brook Drain, and an unnamed tributary leading to Motts Creek are located within the Site area. Motts Creek extends approximately 1,600 feet of the northern extent of the study area. The unnamed tributary and Doxey Brook Drain are classified by NYSDEC as Class C streams, and both features merge and eventually drain into Motts Creek. The unconfined water table is typically lower than the water level in the streams; however, seasonal fluctuations in the water table may result in discharge of groundwater into the surface water. PCE was detected in surface water, sediment, and storm drain samples collected during previous investigations (TtEC DER, 2008).

1.4 Geology and Hydrogeology

Geology

The Site is situated within the Atlantic Coastal Plain Physiographic Province of the United States near the southwestern corner of Long Island, New York. The present geologic conditions along the island are primarily the result of cycles of advancement and retreat of continental glaciers in the area approximately 10,000 years before present (ybp). Sediments associated with the glacial periods include deposits of till, ice-contact stratified drift, outwash materials, and various other mixtures of sediments. The stratified drift and till deposits are concentrated from the terminal moraines in the center of the island northward to the north shore of the island. Unconsolidated Pleistocene – age strata consisting mostly of outwash deposits are present between the moraines and toward the south shore of the island where they overly Cretaceous – age, marine derived sediments and Pre-Cambrian bedrock (TtEC DER, 2008).

Cretaceous – age deposits range from the late Cretaceous Raritan Formation which is composed of an upper clay member (the Raritan clay) and a lower sand member (the Lloyd aquifer) to the Magothy – Matawan group which overlies the Raritan Formation. The Magothy is composed of deltaic quartzose sand of continental origin with some interbedded clay and silt. This formation represents one of the important water bearing units that comprise Long Island's water supply aquifers (TtEC DER, 2008) (USEPA NPL website, 2004).

Overlying the Magothy – Matawan group, and present only in a small area of the subsurface, is the Jameco Gravel. The Jameco is the earliest of the Pleistocene deposits in the region, but has only been detected in Kings County, southern Queens County, and southeastern Nassau County. The thickness of this unit is highly variable owing to its origin as a channel fill deposit within a diversion pathway for the Hudson River which at one time took the course of the river through what is now the southwestern end of Long Island (TtEC DER, 2008) (USGS, 1989).

Above the Jameco Gravel is a blue-grey clay layer, the Gardiners clay, which forms a confining layer over the Jameco and Magothy – Matawan group. The Gardiners was deposited in a marine environment during a interglacial period in the Pleistocene. This unit is the deepest of the units encountered during previous phases of

the investigation at the site with some of the deeper borings associated with the site completed at the interface between the Gardiners clay and the overlying unconsolidated Pleistocene deposits. The sediments above the Gardiners clay are Pleistocene deposits forming the Upper Glacial Aquifer (UGA), the shallowest aquifer on the island. The UGA consists primarily of meltwater derived coalescing sheets of sand and gravel forming an outwash plain extending southward from the terminal moraines to the Atlantic shore. In the vicinity of the Site the UGA includes a thin layer of marine clay (as indicated by the presence of marine shells and plant remains), locally referred to as the "20-foot clay", which was deposited during a phase of warmer climate within the Pleistocene glaciation. The "20-foot clay" thickens southward on the Site and over approximately the southern half of the Site forms a clay layer thick enough to interrupt the hydraulic connection between the shallow and deep portions of the UGA, thereby effectively resulting in semi-confined for the deeper UGA in this area (TtEC DER, 2008) (USGS, 1989).

The surficial and shallow subsurface geology in the Site area typically exhibits a combination of asphalt / pavement, gravel subgrade, and re-worked native soils covering the ground surface throughout the Site. Where present, fill materials typically extend to a depth of approximately 1-foot below grade. Below the fill layer there are sporadic layers of peat and organic silts and fine sands as noted in several subsurface locations near Peninsula Boulevard. Where present this layer was encountered at a depth of approximately 4 to 8 feet bgs and exhibited a maximum thickness of approximately 4 feet. This layer of organic material may correlate with a former creek channel located in the vicinity of the former Grove Cleaners site (TtEC Work Plan, 2005) (USGS, 1989).

Hydrogeology

Regionally, the groundwater regime in this area of Long Island is dominated by a groundwater divide located approximately 2000 ft south of Peninsula Boulevard, along a low ridge trending southwest – northeast. (TtEC DER, 2008) Based on previous characterization at the site, groundwater in the UGA north of the divide exhibits flow with both northerly and westerly components. This depth dependent variability in flow direction within the UGA is supported by water level data collected from wells completed in the shallow (unconfined) and deeper semi-confined intervals of the UGA. South of the divide groundwater flow within the UGA appears to trend southward toward Macy Channel. In this area of Long Island the Jameco gravel, despite its limited extent, is a water bearing zone of primary importance due to hydraulic conductivity values on the order of 200 feet per day. The LIAW well field adjacent to the Site utilizes the Jameco as its source aquifer and this is the reason the Jameco has been identified as the aquifer of concern for the project site. Although the Gardiners clay separates the overlying UGA, which is no longer used as a supply in the vicinity of the site, it does not form a continuous confining layer. North of the Site the UGA directly overlies the Jameco. Given the similar hydraulic properties of the UGA and Jameco there is likely significant hydraulic connection between the two units in close proximity to the Peninsula Boulevard groundwater plume. In addition, the Jameco is hydraulically connected to the deeper Magothy aquifer which is the primary drinking water supply source for Nassau County (USEPA NPL website, 2004) (USGS, 1989).

During August 2009, HDR acquired from the USGS a compilation of records for public water supplies in the vicinity of the site using New York State Department of Environmental Conservation's Public Supply Well database and the USGS Groundwater Site Inventory (GWSI) and National Water Information System (NWIS) database. These records provide the coordinates, water bearing aquifer, drilled depth, and screened interval for public water supply wells in the vicinity of the Peninsula Boulevard site. These data will be used to assist in further evaluating the potential pumping impacts on the surrounding aquifers and resultant migration of the contaminant plume, specifically with respect to hydraulic connection and potential vertical migration within the UGA – Jameco – Magothy system.

At the project Site, previously conducted drilling, sampling and aquifer tests have been limited to the unconfined and semi-confined portions of the UGA. In-situ hydraulic testing and aquifer pump tests indicate horizontal hydraulic conductivity values for the on-site UGA material in the unconfined portion of the aquifer on the order of 5 feet per day (fpd), with individual test results yielding values as high as 155 fpd. In the deeper, semi-confined portion of the UGA horizontal hydraulic conductivity values of approximately 40 – 50 fpd were calculated, with individual tests results of as much as 200 fpd. The interbedded nature of sediments in the UGA due to its depositional environment suggests significant vertical and horizontal variability in hydraulic conductivity values would be anticipated (TtEC DER, 2005).

Based on previous measurements conducted during drilling and testing at the Site, the depth to groundwater within the unconfined portion of the UGA ranges from approximately 3 to 15 ft bgs, while ranging from 6 to 17 ft bgs in the semi-confined portion of aquifer. Saturated thickness of the unconfined UGA above the "20-ft clay" layer ranges from 10 to 30 ft. Saturated thickness of the deeper portion of the UGA below the "20-ft clay", including the pressure head component imparted by the semi-confined conditions, is approximately 55 to 65 ft (TtEC DER, 2005).

Existing groundwater elevation data collected from monitoring well clusters installed during previous phases of the investigation suggests that a significant downward vertical gradient exist between the unconfined and semi-confined portions of the UGA, especially toward the south end of the Site along Broadway and West Broadway where vertical gradients on the order of -0.1 ft/ft were calculated (TtEC DER, 2005).

Previous monitoring of water levels from on-site wells does not indicate that tidal fluctuation of the water table exists at the Site. No significant change was noted from manually collected water levels over a period encompassing at least one tidal cycle. Pressure transducer readings collected from other wells on-site likewise exhibited no tidal signature over the period of record (TtEC DER, 2005).

1.5 Surface Water Hydrology

The unnamed Motts tributary and Doxey Brook Drain are both classified as Class C streams. See Figure 3 for Surface Water Map. While the groundwater table is typically lower than the stream level, seasonal fluctuations in the water table may result in groundwater discharge to surface water. Surface water runoff in the Site area is diverted to storm water collection basins and interconnected manholes located throughout the area. The water is diverted to the north and west from the storm water drainage system to the Motts tributary or Doxey Brook Drain. The Motts tributary and Doxey Brook Drain merge about 1,500 feet northwest of the Site and discharge into Motts Creek approximately 1,000 feet northwest of their confluence. Motts Creek flows southwest about two miles and discharges into Head of Bay, which in turn flows into Jamaica Bay, and into the Atlantic Ocean (TtEC DER, 2005).

1.6 Topography

Topographically, the Site slopes north and west toward Motts Creek with surface elevations decreasing from approximately 15 ft above mean sea level (msl) near the southern border of the Site to approximately 1 ft msl in the vicinity of the nearby LIAW property ([TtEC Work Plan, 2005).

2 Summary of Site Conditions

2.1 Former Grove Cleaners (NYSDEC)

Operations at the former Grove Cleaners (located at 1274 Peninsula Boulevard) from 1987 – 1992 resulted in the disposal of hazardous wastes to the environment, including PCE. NCDH cited Grove Cleaners in March 1991 for discharging hazardous waste into on-site dry wells. NYSDEC classified the Grove Cleaners site as a Class 2 Inactive Hazardous Waste Disposal Site in March 1993, which resulted in environmental investigation efforts being conducted at the site. Between March 2000 and October 2001, TAMS/GZA conducted sampling on and around the former Grove Cleaners site, which are presented in *"Final Remedial Investigation Grove Cleaners Site No. 1-30-059"*, February 2002 (TAMS/GZA, 2002). The results of this investigation were used as a starting point for the Peninsula Boulevard Groundwater Plume Site RI. PCE was detected in groundwater and other environmental samples collected at the Grove Cleaners site, and at select off-site areas. A No Further Action remedy was selected by NYSDEC for the former Grove Cleaners site, following the implementation of interim remedial measures (IRMs).

2.2 Peninsula Boulevard Groundwater Plume Superfund Site (2004-2007)

The Site was referred to EPA after NYSDEC concluded that the contamination present in the groundwater did not originate solely from the former Grove Cleaners site. The EPA assumed responsibility for the (larger) Peninsula Boulevard Groundwater Plume Site in September 2002. A HRSP was prepared in March 2004, and the Site scored 50 of a possible 100 points, placing the Site on the NPL in August 2004.

TtFW, under EPA Contract Number 68-W-98-214, performed investigation work in the Site area starting in August 2006. A detailed description of TtFW's field sampling methods and analytical results / interpretations is included in the October 2008 *Data Evaluation Report*. PCE was detected in several groundwater samples throughout the Site, with concentrations exceeding 5,000 ug/L at some locations. A summary of the findings of this report, by media sampled, is provided below.

It should be noted that EPA conducted air sampling at the North Woodmere Middle School to determine if the air in the school was being impacted from vapor intrusion from the PCE plume. According to the WAM, results of the air sampling indicated that the school was not being impacted by the plume. EPA is also conducting vapor intrusion evaluations at residences in the Site area.

Soils

Subsurface Soils

Sixteen VOCs were detected in the site area during direct push subsurface soil sampling. Concentrations of individual constituents ranged from 0.13 J ug/kg to 5,300 ug/kg. Exceedances of applicable criteria were observed only for acetone in four samples (DP-016, DP-017, DP-020, and DP-022) in the west-northwest portion of the Site. Low levels of PCE were detected in two soil samples at concentrations of 1.1 and 2.4 ug/kg. TCE was detected in one soil sample at a concentration of 0.33 ug/kg.

The direct push subsurface soil samples contained detectable levels of 22 semi-volatile organic compounds (SVOCs), mainly polycyclic aromatic hydrocarbons (PAHs). Concentrations were detected between 7.8 J ug/kg and 1300 ug/kg. One SVOC, benzo(a)pyrene, occurred at concentrations exceeding comparison criteria at boring locations.

Fourteen pesticides were also present in the direct push subsurface soil samples collected from the Site, at concentrations up to 29 ug/kg. No pesticide constituents were detected at levels above comparison criteria. One PCB (Aroclor 1260) was detected in the subsurface soil (one location), at a concentration of 15 J ug/kg, below comparison criteria.

The direct push subsurface soil sampling activities detected 20 metals, with concentrations ranging from 0.027 mg/kg to 14,000 mg/kg. Two of the metals, arsenic and magnesium, were present at concentrations above their respective human health-based or state values comparison criteria values; however, these metals were not reported to exceed site-specific background concentrations. Arsenic was detected at elevated (above comparison criteria) levels in 32 of the 39 (including duplicate) direct push subsurface soil samples, while magnesium was detected at elevated values in 24 samples. An additional five metals (barium, manganese, mercury, vanadium, and zinc) were detected at concentrations above their respective background values (which are calculated using the concentrations detected in the background soil borings) without exceeding human health-based or state values.

Sewer Trench Soils

Sewer trench soil samples were collected from 10 borings at locations adjacent to sewer and storm sewer lines for purposes of obtaining representative samples of the trench bedding material. One VOC, PCE, was detected during the trench soil investigation at boring DP-058 (6-10 ft bgs); the concentration reportedly exceeded comparison criteria.

No SVOCs or PCBs were detected in the trench soil samples. Two pesticides (4,4'-DDT and gamma-chlordane) were detected in the trench soil sample from DP-058; however, no exceedences in comparison criteria were reported. Seventeen metals were detected in the trench soil samples at concentrations ranging from 0.069 mg/kg to 9,700 mg/kg. Of these, two metals, arsenic and magnesium, were detected at levels above comparison criteria. One metal, manganese, was detected at concentrations above background concentrations. Arsenic and manganese were both detected at elevated concentrations in 6 out of the 11 samples (including the duplicate).

Surface Soils

A total of twelve surface soil samples and one duplicate sample were collected from depths of 0 to 1 feet bgs at locations along the plume and in areas of potential elevated exposure potential. The surface soil sampling was intended to be used to delineate the nature and extent of impacted areas and to aid in ecological risk assessment. Twelve additional soil samples (plus one duplicate sample) were collected along the plume from a depth of 0 to 2 feet bgs to aid in the human health risk assessment. A total of 26 shallow soil samples were collected (including duplicates).

No VOCs were detected in the surface soil samples. A total of 20 SVOCs, mainly PAHs, were detected. Concentrations of individual constituents ranged from 43 J ug/kg to 3,400 ug/kg. Seven of these compounds (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, and phenol) were reported to be detected at concentrations above comparison criteria. The highest concentrations for the detected SVOCs generally occurred at location SL-PB10, which is located at the corner of Peninsula Boulevard and Hamilton Avenue. The elevated PAH concentrations at this location may be due to the proximity to Peninsula Boulevard, a heavily traveled road.

A total of 14 pesticides were detected in the risk assessment soil samples, with. concentrations ranging from 0.39 J ug/kg to 780 ug/kg. Of these, five pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, beta-BHC, and dieldrin) were detected at levels exceeding comparison criteria. 4,4'-DDE and 4,4'-DDT were detected in a majority of the samples at concentrations above comparison criteria. One PCB, Aroclor1260, was detected at location SL-PB05

from 0 to 1 feet bgs, as well as the associated duplicate sample. The reported concentrations of Aroclor1260 were 67 ug/kg in the primary sample and 41 J ug/kg in the duplicate sample. Both results are below comparison criteria for surface soil.

The surface soil samples were reported to contain detectable levels of 19 metals. Eight of the metals (antimony, arsenic, chromium, lead, magnesium, mercury, vanadium, and zinc) were present at concentrations that were above at least one of their comparison criteria values (human health and the typically more restrictive ecological criteria). Four metals (arsenic, chromium, vanadium, and zinc) were detected in all surface soil samples at concentrations greater than at least one of the comparison criteria.

Background Soil Samples

Five surface (0 to 2 ft bgs) and five subsurface soil samples (2 to 4 feet bgs) were collected off-site to identify background soil concentrations of various constituents for comparison to on-site levels. Background data can be utilized to further evaluate data sets and in human health risk assessment. The background soil samples were submitted for laboratory analysis for TCL Organics, TAL Metals and TOC. Analytical results of the soil samples indicated VOCs were not present in any of the background soil samples at levels above the laboratory detection limits. Nineteen metals were detected in the surface soil samples at levels above the laboratory detection limit. Seventeen metals were detected in subsurface soil samples at levels above the laboratory detection limit.

Groundwater

Hydropunch Groundwater Samples

Hydropunch groundwater samples were collected from 62 locations selected based upon membrane interface probe (MIP) screening. 156 hydropunch groundwater samples were collected and analyzed for VOCs via an on-site by field gas chromatograph (GC). To verify the field GC methodology, the first five samples collected for field GC screening, and 25 percent of all samples collected thereafter, were split and sent to the RAS laboratory for analysis (total of 47 analyzed off-site). Based upon the MIP results and the subsequent VOC screening by the on-site field GC, it appeared there was a contamination zone located at / below -40 feet msl at the southeastern portion of the Site. Additional borings were completed to collect groundwater from below -10 feet msl. In addition, five hydropunch groundwater samples were analyzed by the CLP laboratory.

Shallow (Unconfined Portion of the Upper Glacial Aquifer and "20-Foot Clay") Hydropunch Groundwater Samples

During the initial MIP investigation (summer 2006), 112 shallow (within the unconfined portion of the Upper Glacial Aquifer and the "20-Foot Clay") hydropunch groundwater samples were collected from 40 locations. All samples were screened for VOCs using the on-site field GC, and 33 of the samples were split to a CLP laboratory for confirmatory analysis. PCE was found in many of the locations at levels above groundwater comparison criteria. A second MIP investigation was conducted in spring 2007, to attempt to delineate the extent of the shallow plume. A total of 42 hydropunch groundwater samples from 17 locations were screened by the on-site field GC, with 22 samples being split with a CLP laboratory.

Sixteen VOCs were detected during field GC screening of the shallow hydropunch groundwater samples. Concentrations ranged from 1.5 ug/L to 7,751 D ug/L, with the primary contaminants consisting of PCE, trichloroethene (TCE), benzene, and trans-1,2-dichloroethene. Exceedances of applicable criteria were observed for 13 constituents.

Twenty-seven VOCs were detected in the CLP confirmation samples for the shallow hydropunch groundwater samples, with concentrations ranging from 0.052 J ug/L to 1,200 ug/L for these analyses. Exceedances of applicable criteria were observed for eight constituents (1,2-dichloroethane, benzene, cis-1,2-dichloroethene, methyl-tert-butyl ether, PCE, trans-1,2-dichloroethene, TCE, and vinyl chloride).

PCE was detected in 81 of the 153 field GC-screened shallow hydropunch groundwater samples, for a frequency of detection of 0.52. Of these detections, PCE concentrations were greater than applicable comparison criteria in 78 samples. PCE was also detected in 37 of the 55 samples sent for analysis at a CLP laboratory, for a frequency of detection of 0.67, and exceeding comparison criteria in 20 of the samples.

TtFW concluded that a continuous area of PCE contamination (i.e., above comparison criteria of 5 ug/L) exists. The retarded vertical groundwater velocities likely caused by the reduced permeability "20-foot clay" unit may cause the contamination to disperse and form a wide groundwater plume within the unconfined portion of the Upper Glacial Aquifer. The "20-foot clay" unit may act as a layer for DNAPL to pool at the surface. This interval contains two distinct areas of higher PCE concentrations. The first area is located southwest of the former Grove Cleaners site, with a maximum detected PCE concentration of 7,751 ug/L (hydropunch HW-006). The second high concentration area is found to the south-southeast of the former Grove Cleaners site, and contained maximum concentrations of 4,890 ug/L (HW-037) for PCE. Groundwater elevation data indicates shallow groundwater is generally flowing towards the northwest, indicating the second high concentration area south-southeast of the former Grove Cleaners site is likely from a contamination source other than Grove Cleaners.

PCE has a solubility of 200,000 ug/L, and may be present in the subsurface as a DNAPL at locations where the concentration of PCE in groundwater is above 1 percent of its solubility (i.e., greater than 2,000 ug/L) (EPA, 1996). PCE concentrations appear to generally increase with increasing depth, with several concentrations above 1% of the solubility of PCE . For the interval above – 10 feet msl, HW-028 had a PCE concentration of 2,100 ug/L. The -10 to -40 feet msl interval showed higher concentrations of PCE, with three locations having PCE concentrations above 2,000 ug/L (HW-006, HW-012, and HW-037, with PCE concentrations of 7,751 ug/L, 2,300 ug/L, and 4,890 ug/L, respectively).

Benzene, ethylbenzene, and methyl-tert-butyl-ether (MTBE) were detected at levels above either groundwater criteria at two separate areas of the Site. The first area is at a location north of Peninsula Boulevard and near Doxey Brook Drain. The second area is located in the central portion of the Site (generally west of Hewlett Parkway) and extends horizontally to the north. The distribution of these contaminants generally follows the direction of shallow groundwater flow direction within the unconfined portion of the Upper Glacial Aquifer.

Deep (Semi-confined Portion of the Upper Glacial Aquifer) Hydropunch Groundwater Samples

During the initial summer 2006 MIP investigation, six deep (within the semi-confined portion of the Upper Glacial Aquifer) hydropunch groundwater samples were collected from two locations (HW-037 and HW-038). All samples were screened for VOCs using the on-site field GC, and two of the samples were split to a CLP laboratory for confirmatory analysis. Additional deep MIP locations were sampled east of these two locations in an attempt to define the extent of the PCE plume in the semi-confined portion of the Upper Glacial Aquifer. A total of five hydropunch groundwater samples from 76 to 80 feet bgs were sent for analysis to a CLP laboratory. These additional samples did not contain PCE in concentrations above comparison criteria.

Nineteen VOCs were detected in the deep hydropunch groundwater samples, with concentrations ranging from 0.061 J ug/L to 23,353 D ug/L for these analyses. Exceedances of applicable criteria were observed for nine constituents (1,2-dichloroethane, 1,2-dichlorobenzene, 1,4-dichlorobenzene, benzene, cis-1,2-dichloroethene, PCE,

trans-1,2-dichloroethene, TCE, and vinyl chloride). PCE was detected in 9 of the 11 deep hydropunch groundwater samples, with concentrations greater than applicable comparison criteria in 6 samples.

An area of high PCE concentrations was identified is located around HW-037 and HW-038 (south-central portion of the Site, east of Hewlett Parkway). Samples from both locations contained concentrations of PCE significantly exceeding 1 percent of the solubility of PCE (2,000 ug/L) indicating DNAPL may be present. Elevated concentrations of benzene were also noted in this area.

Monitoring Well Groundwater Samples

Monitoring wells were installed to better assess groundwater quality at the Site. One round of groundwater samples was collected from 21 shallow monitoring wells (including the county well, N1114) and 6 deep monitoring wells. Groundwater samples collected from the wells during the field investigation by TtEC showed occurrences of PCE and, at lower concentrations, some of its reductive dechlorination degradation products (e.g., TCE, cis-1,2-DCE, and vinyl chloride). PCE was detected in 17 of the 27 wells sampled. Exceedances of PCE for human health-based and state comparison criteria values (5 ug/L) were noted in the following eight shallow wells: MW-03D (1,000 ug/L), MW-03S (1,000 ug/L), MW-07 (1,300 ug/L), MW-08 (430 ug/L). MW-10S (27 ug/L), MW-15S (5.4 ug/L), MW-18S (5.9 ug/L), and MW-21S (140 ug/L). Two deep wells had concentrations of PCE greater than comparison criteria, MW-15D (20 ug/L) and MW-21D (2,600 ug/L; also 2,800 ug/L in the duplicate).

The primary groundwater plume appears to be present within the unconfined portion of the Upper Glacial Aquifer located near the former Grove Cleaners site (near wells MW-03S/D and MW-07), but to the southwest of the property and sidegradient of the general direction of groundwater flow. A secondary groundwater plume is located near monitoring well MW-21S (south-central area of the Site), which is upgradient of the former Grove Cleaners site. The location of both plumes, especially the secondary groundwater plume, indicates the potential for additional sources to be present within the study area.

The two deep wells with PCE concentrations exceeding applicable groundwater cleanup criteria are both located upgradient of the former Grove Cleaners property. The results of the groundwater samples collected from the hydropunch and monitoring wells located within the semi-confined portion of the Upper Glacial Aquifer indicate this zone is impacted by PCE contamination. The PCE concentration at MW-21D (2,800 ug/L) is above the one percent solubility which indicates the likely presence of DNAPL, although none was reported to be observed during sampling. The vertical and horizontal extents of the PCE levels observed in the semi-confined portion of the Upper Glacial Aquifer, and the source(s) of these impacts, are currently unknown.

Twenty other VOCs were also detected in groundwater samples collected during the monitoring well investigation, with four compounds, in addition to those discussed above, having concentrations exceeding comparison criteria: benzene, ethylbenzene, isopropyl benzene, and MTBE. Horizontal and vertical delineations of these compounds have also not been achieved, and a source of the petroleum-related VOCs has not been identified.

Ten SVOCs were detected in the groundwater samples collected from monitoring wells during the 2007 sampling event. Concentrations ranged from 1 J ug/L to 22 ug/L. Applicable groundwater comparison criteria were exceeded for anthracene (one location), and for bis(2-ethylhexyl)phthalate (2 locations). One pesticide, dieldrin, was detected in two of the groundwater samples collected. Dieldrin was detected at a maximum concentration of 0.039 J ug/l, above the comparison criteria of 0.004 ug/L.

The groundwater well samples were also analyzed for metals. The analysis indicated detections of 13 metals. Three metals, arsenic, chromium, and nickel, had relatively low frequencies of exceedances above groundwater criteria. Four other metals, aluminum, iron, manganese, and sodium, were detected at levels above comparison criteria in the majority of the monitoring well groundwater samples.

Sediment

Six sediment samples (and one duplicate) were collected during the 2007 field investigation, as follows: two from the culvert between Woodmere Middle School and the KeySpan facility (SW-01 and SW-02), two from the Doxey Brook Drain (SW-03 and SW-04), one from Motts Creek (SW-05), and one background location (SW-06). The sediment sample locations were co-located with the surface water sample locations.

Five VOCs were detected in the sediment samples, at concentrations ranging from 5.5 J ug/kg to 190 ug/kg. The sample from SW-02 contained carbon disulfide in excess of ecological-based comparison criteria. In addition, acetone was present in all of the sediment samples (except the duplicate) at levels greater than its eco-based comparison criterion.

Twenty-three SVOCs (generally PAHs) were detected in the sediment samples. Concentrations of these constituents ranged from 24 J ug/kg to 11,000 ug/kg. Sixteen SVOCs were reported to exceed state and/or ecological-based criteria for sediments. The highest number of SVOCs and the maximum concentrations were generally present in a sample from the Doxey Brook Drain, at location SW-04.

Six of the seven detected pesticides (4,4'-DDD; 4,4'-DDE; 4,4'-DDT; alpha-chlordane; dieldrin; and gamma-chlordane) were reported at concentrations above comparison criteria in at least one of the sediment samples. In general, the maximum concentrations were present in the samples located in the culvert between Woodmere Middle School and the KeySpan facility (SW-01 and SW-02).

The sediment samples contained concentrations of up to 19 metals, and comparison criteria values were exceeded by five of these constituents (cadmium, copper, lead, mercury, and zinc). Copper and lead were detected at concentrations exceeding both state and ecological-based criteria in four sediment locations (plus the duplicate sample for lead). Cadmium and zinc concentrations exceeded criteria in the samples from SW-02 and SW-04, while mercury was detected at levels above comparison criteria in SW-02. No exceedance of metals was observed in SW-03 or the background sample.

Surface Water

Six surface water samples were collected at locations co-located with the sediment sample locations. PCE was detected above comparison criteria in all surface water samples with concentrations ranging from 3.3 ug/L (SW-06, background) to 49 ug/L (SW-02). In addition, all of the locations contained varying levels of the reductive chlorination products TCE and cis-1,2-DCE. Three locations (SW-03, SW-04, and SW-05 [and its associated duplicate]) had concentrations of TCE above comparison criteria (up to 4.3 ug/L at SW-03). The levels present in the surface water samples are expected to be site-related, based on comparisons made to background data.

One SVOC was detected in the duplicate sample collected from SW-05. Bis(2-ethylhexyl)phthalate was present at 9.2 ug/L, exceeding its comparison criterion. No other SVOCs and no pesticide compounds were found in the surface water samples. The surface water samples contained seven metals, and comparison criteria were exceeded for two of these constituents. Iron was present above criteria in all of the surface water samples except the background location (SW-06), while manganese exceeded the criteria in all locations.

Six interstitial water samples were collected for VOCs to determine the potential for interaction between surface water and groundwater. Three samples were collected from the culvert between Woodmere Middle School and the KeySpan facility, two from Motts Creek. A background sample was also collected. Ten VOCs were detected in the interstitial water samples, with concentrations ranging from 0.13 J ug/L to 19 ug/L. PCE was detected at concentrations exceeding comparison criteria at two locations (15 ug/L and 7 ug/L). In addition, toluene had an elevated concentration at one location (19 ug/L), while vinyl chloride was above criteria at two sample locations (reported concentrations of 1.8 ug/L and 0.81 ug/L). Only PCE was detected in the background location, at a relatively low concentration (0.16 J ug/L).

3 Task Plan for Remedial Investigation / Feasibility Study

Based on the May 28, 2009 EPA SOW, the following tasks will be conducted by HDR to complete the RI/FS at the Peninsula Boulevard Groundwater Plume Site:

Task 1	Project Planning and Support
Task 1.13	Pathway Analysis Report
Task 2	Community Relations
Task 3	Field Investigation
Task 4	Sample Analysis
Task 5	Analytical Support and Data Validation
Task 6	Data Evaluation
Task 7	Risk Assessment
Task 9	Remedial Investigation Report
Task 10	Identification and Screening of Remedial Alternatives
Task 11	Remedial Alternatives Evaluation
Task 12	Feasibility Study Report
Task 13	Feasibility Study Addendum
Task 16	Work Assignment Closeout

3.1 Task 1 - Project Planning and Support

3.1.1 Project Administration/Management

HDR will provide project administration and management for the duration of the work assignment. The HDR project team will consist of the Contract Manager, Project Manager, Project Hydrogeologist, Project Scientists, and support staff, and subcontractors. An organizational chart is included as Figure 4. The Project Manager will be the primary interface between the EPA Work Assignment Manager (WAM) and HDR's technical staff and subcontractors. The Project Manager will manage day to day activities, interface with the EPA WAM on a weekly basis, conduct bi-weekly invoice reviews and inputs to HDR CONNECTS (HDR's automated financial management system), attend project meetings, oversee and coordinate the project, and manage project staff, budget, and task schedules. Project Administration/Management time has been estimated to direct and manage efforts including staffing plans, budget tracking, project scheduling and establishing internal quality management procedures.

3.1.2 Attend Scoping Meeting

HDR attended a scoping meeting at EPA's New York City office on July 8, 2009. Four HDR personnel participated in the scoping meeting. Minutes of the scoping meeting were prepared by HDR and distributed to the EPA WAM within five calendar days following the meeting's conclusion.

3.1.3 Conduct Site Visit

HDR conducted a one-day site visit on July 13, 2009 with the EPA WAM to develop an understanding of the site layout and the RI/FS scope and requirements. Two HDR personnel participated in the site visit. An additional site visit was conducted on August 12, 2009 by the HDR project Hydrogeologist. The Site was inspected for potential drilling access issues and for potential issues with underground and overhead utilities at the proposed drilling locations. Photographs in the vicinity of the proposed monitoring wells were taken for later reference, and the approximate locations were recorded using a hand-held Global Positioning System (GPS) unit for later addition to a base map of the Site. Observations from the site visit were used directly to refine the proposed locations for the proposed monitoring wells.

3.1.4 Develop Draft Work Plan and Associated Cost Estimate

This WP was prepared by HDR based on information from the RI/FS SOW and project schedule, as well as EPA guidance documents, background/existing data from previous investigations, site visit observations, scoping meeting discussion, and technical direction provided by the EPA WAM. This WP provides a detailed description of each project task including deliverables/documentation and staffing plan. A task-by-task budget estimate was submitted as Volume 2.

3.1.5 Negotiate and Revise Draft Work Plan Budget

Following the draft WP submittal and EPA review, the scope and budget estimate were discussed. This final WP document incorporates the discussion items. Both electronic and hard copies of the document are being submitted to EPA.

3.1.6 Evaluate Existing Data and Documents

Existing Site background information will be reviewed by HDR. HDR's review of available background information provided by the EPA WAM includes:

- DER for the Peninsula Boulevard Groundwater Plume RI/FS, Town of Hempstead, Village of Hewlett, Nassau County, New York, Volumes I and II, Tetra Tech EC, Inc. (TtEC), October 2008.
- Final RI/FS WP, Peninsula Boulevard Groundwater Plume RI/FS, Town of Hempstead, Village of Hewlett, Nassau County, New York, with Appendix A and Appendix B, TtFW, April 2005.
- Final Remedial Investigation (RI), Grove Cleaners, Site No. 1-20-059, TAMS & GZA of NY, February 2002.
- March 2008, July 2008, and February 2009 Soil Vapor Intrusion Sampling (SVIS) documents, EPA.

Addition site-related information – as available – will also be reviewed by HDR for the RI/FS. Potential references that may be reviewed include those from ATSDR, NCDH (FOIA requests for dry cleaners within or near the site area were submitted in August 2009), and USGS (including information on the LIAW well field 5 located north of the plume area). It should be noted that EPA, through the Program Support Branch, has funded an Interagency

Agreement with USGS that may be renewed for FY2010 and which could provide technical assistance for the RI/FS.

3.1.7 Quality Assurance Project Plan

HDR has prepared a QAPP for the RI/FS in accordance with the Uniform Federal Policy (UFP) for QAPP guidance and procedures (see Attachment A). The QAPP describes the project objectives and organization (including routine analytical services required), functional activities, field activities and protocols, and quality assurance/quality control (QA/QC) protocols used to achieve the desired Data Quality Objectives (DQOs). Draft and Final QAPPs have been prepared. Information to be provided in the QAPP includes:

- Project sampling objectives;
- Standard Operating Procedures (SOPs) for the field investigation activities, including required sampling equipment;
- Sample documentation and chain-of-custody (COC) procedures;
- Sample handling, preservation, and shipment procedures;
- A table of sample numbers, matrices, locations, collection frequencies, and analytical methods;
- A breakout of samples to be analyzed via the EPA Contract Laboratory Program (CLP), the EPA Region 2 Division of Environmental Science and Assessment (DESA) Laboratory, and other Non-CLP providers (if required);
- Calibration and maintenance procedures and requirements;
- QA/QC protocols and sample requirements;
- Requirements for project assessments/audits;
- Procedures for data reduction, validation, and reporting;
- Description of report deliverables; and
- Corrective action procedures.

Non-RAS analyses are not anticipated at the current time, and are not included in this scope of work.

3.1.8 Health and Safety Plan

A site-specific HASP that specifies employee training, protective equipment, medical surveillance requirements, standard operating procedures and a contingency plan in accordance with 29 CFR 1910.120 (1)(1) and (1)(2), has been prepared by HDR and is provided as Attachment B. Task specific health and safety risks, personnel protective equipment, employee training, medical surveillance requirements are addressed in the HASP in accordance with 40 CFR 300.150 of the NCP and 29 CFR 1910.120 1(1) and (1)(2). The HASP will be updated by HDR, if warranted, when new conditions or work requirements are identified.

3.1.9 Meetings

HDR shall participate in progress meetings during the course of the work assignment. The budget estimate assumes eight (8) project meetings in the EPA's New York City office. Each meeting is estimated at an 8-hour duration. HDR will provide 2 personnel at each meeting. Draft meeting minutes will be prepared and circulated by HDR following each meeting, and final meeting minutes will be submitted to incorporate EPA comments.

3.1.10 Subcontract Procurement

HDR has determined that seven subcontracts will be required for this work assignment: driller for well installations; geophysical contractor for utility mark-outs; land surveyor to integrate new monitoring well locational information onto existing site maps; a contractor for the transport and disposal of investigation-derived wastes (IDW); a supplier of sample glassware; a field equipment provider.and microfilming.

3.1.11 Subcontract Management

HDR will perform subcontract management for the duration of the project, as needed, including:

- Implementing procedures for subcontractor management;
- Field audits of procedures and QC (if applicable)
- Monitoring of subcontractor progress and performance;
- Maintaining subcontracting systems and records;
- Issuing subcontract modifications (if warranted), and helping to resolving issues that affect subcontractor performance on the project;
- Reviewing and approving subcontractor invoices;
- Maintaining subcontract files;
- Identifying opportunities to encourage or implement sustainable practices among subcontractor activities (and appropriately document / report activities to EPA);
- Coordinating subcontractor activities with EPA; and
- Closing each subcontract.

All on-site subcontractor activities (such as drilling, surveying, geophysical survey) will be monitored on a daily basis by the HDR Field Leader. Subcontractor activities performed off-site (e.g., IDW transportation and disposal) will be managed by the Project Manager or his designee.

Any changes to a subcontractor's scope of work will be reported to the HDR Project Manager so that a proper determination can be made as to the need to modify the subcontractor's scope of work and/or compensation. Significant issues will be brought to the attention of the EPA WAM immediately. After an evaluation of the proposed change by HDR and receipt of the EPA Contracting Officer's consent (if required), a subcontract modification may then be issued to effect the change. A change of any subcontractor's scope of work will not be made without a prior determination of appropriateness, and will be made only by modification of the subcontract.

All subcontractor invoices will be submitted to HDR for review and approval. After approval by the Project Manager or designee, the invoice will be submitted to the HDR Accounting Department for inclusion on the project invoice.

3.1.12 Pathways Analysis Report

HDR will prepare a Pathways Analysis Report (PAR) for the Site in accordance with "Risk Assessment Guidelines for Superfund, Part D" (RAGS Part D). The PAR will precede preparation of a Draft Baseline Human Health Risk Assessment (BHHRA) (Task 7.01) for the Site. The PAR will present the proposed approaches and methodologies to be used for the background review (exposure setting), data evaluation (identification of chemical of potential concern [COPC] in different media), exposure pathway analysis, exposure assessment, toxicological evaluation, and associated RAGS Part D tables required for the Draft BHHRA. [Preparation of the

Draft BHHRA, which is contingent upon approval of the PAR by EPA Region 2, is discussed in detail in Section 3.7.1 of this Work Plan.]

The following subsections discuss the anticipated components of the PAR.

Background Review / Exposure Setting

The background review will summarize the site history, current and future land use scenarios, and present a BHHRA Conceptual Site Model for the Site. The human health SCM may evolve throughout the RI/FS, based on information obtained and interpretations made.

A site reconnaissance will be conducted and will include field surveys to identify potential environmental migration pathways, potential human receptors, possible human exposure routes, and site conditions / human activities of relevance (e.g., exposure to potentially impacted sediment / surface water via trespassing or breaches in security fencing). The PAR site reconnaissance is proposed to be conducted during the Field Investigation mobilization task (discussed below in Section 3.3.1). Information collected during the site reconnaissance activities will be incorporated into the PAR.

The background review will also obtain an updated summary of the vapor intrusion assessment work being conducted by EPA and present descriptions of existing sub-slab soil gas and indoor data, forecasted sampling and assessment work, and mitigation measures (such as installation of sub-slab depressurization systems) that have been implemented or planned. In addition, data regarding the LIAW operation, monitoring, and maintenance of engineered controls to reduce concentrations of VOCs in raw water influent will be presented. HDR will attempt to coordinate a meeting with LIAW representatives during the PAR site reconnaissance for purposes of obtaining more information about the potable water pathway.

The PAR will present the project's BHHRA Conceptual Site Model that will be developed based on the background review and site reconnaissance work. One or more tables (based on RAGS guidance) will identify the human health receptors / land uses, scenario time frames, exposure media and exposure points, receptor populations and ages, and rationales for selecting or excluding potential exposure pathways. Based on a preliminary review of available background information, the following have been identified as potential exposure areas and exposure pathways to be presented and addressed in the PAR:

- KeySpan Property - current/future scenarios (adult)
- Woodmere School Property - current/future scenarios (school child; adult)
- Northern Residential Area - current/future scenarios (child; adult)
- Southern Residential Area - current/future scenarios (child; adult)
- Commercial areas (adult)
- LIAW workers (adult)
- Utility workers (adult)
- Recreators (child; adult)

Note that the above inventory may be modified following the exposure setting review and site reconnaissance.

Media of interest for the PAR may include all or a subset of the following:

- Surface soil
- Subsurface soil
- Outdoor air

- Groundwater-to-Indoor Air / Soil Gas (information to be obtained from EPA)
- Surface Water (including drainage structures)
- Sediment
- Groundwater (direct contact; potable pathway)

Data Evaluation

HDR will review available information on the contaminants present in all soil, groundwater, surface water, sediment, and air (soil gas) in each area and will identify the major COPC. Information to be used in identifying COPCs will be derived from site-specific findings made during the site reconnaissance, available historic analytical data (i.e., from TtFW, EPA, NYSDEC, NCDH, USGS, LIAW, ATSDR, or other sources), and analytical results acquired during the RI.

Once the analytical data are compiled and tabulated, a multi-step screening process will be used to identify the COPCs to be retained for the BHHRA. The specific steps followed in this process are described in EPA RAGS Part A (EPA, 1989) and presented below. Validated data as defined in RAGS Part A (EPA, 1989) and the "Guidance for Data Useability in Risk Assessment (Part A)," (EPA, 1992b) will be used in the BHHRA. However, other existing data that does not meet the above-referenced data validation requirements may be evaluated to present a separate qualitative discussion in the BHHRA.

The COPC selection process will be conducted as follows:

Frequency of Detection - Constituents occurring at a low frequency of detection (less than 1 detection in 20 samples) will be eliminated from the COPC list in accordance with RAGS guidance (EPA, 1989).

Known Human Carcinogens - A chemical classified as a known human carcinogen (weight-of-evidence classification A) will be retained as a COPC, regardless of concentration or frequency of detection. EPA's weight-of-evidence classification system will be discussed in greater detail in the BHHRA.

Essential Nutrients - Naturally occurring elements considered essential for human nutrition (calcium, magnesium, potassium, and sodium) will be eliminated from the COPC list in accordance with RAGS Part A guidance (EPA, 1989). In addition, area "background" data for inorganics concentrations in soils (as may be obtained from EPA or NYSDEC) may also be evaluated to screen COPCs.

Comparison to Risk-Based Screening Criteria - The maximum concentration of each chemical will be compared to a risk-based screening value. Chemicals whose maximum detected concentration (MDC) are below the screening value will be eliminated from the COPC list. Screening toxicity values will be derived from the most up-to-date version of EPA's "Regional Screening Levels (RSL) for Chemical Contaminants at Superfund Sites for residential-use soil use (soil and sediment), tap water (for groundwater and surface water), and for residential air concentrations (if needed) (EPA 2009). The RSLs will correspond to the screening toxicity values associated with a 10^{-6} risk for carcinogenic effects or a noncarcinogenic hazard index of 0.1. (Note: Using 10 percent of the screening criteria for noncarcinogens (i.e., HI of 0.1) is recommended by EPA).

Chemicals without Available Toxicological Data - If there is no screening toxicity value for a detected chemical, that chemical will be retained as a COPC.

The resulting COPCs will be summarized in tables titled, "Occurrence, Distribution, and Selection of Chemicals of Potential Concern." The following information will be included in the table: minimum and maximum concentrations, data qualifiers, units, detection frequency, range of detection limits, concentration used for screening, background value, screening toxicity value, potential Applicable or Relevant and Appropriate Requirement (ARAR)/To Be Considered (TBC) value (s), whether or not that chemical was selected as a COPC for this risk assessment (COPC flag), and the rationale for the chemical's deletion or selection.

Exposure Pathway Analysis / Exposure Assessment

An exposure assessment will be performed to identify potential human receptors and exposure routes, and calculate magnitudes of actual or potential human exposures based on contaminant concentrations, frequency of occurrence, and duration of exposure. The exposure assessment addresses each potential current and future exposure pathway, focusing primarily on the media of interest identified above at the various locations identified throughout the Site.

Exposure point concentrations (EPCs) will be calculated for each media, by site and/or specific area of interest (e.g., school or residential area), as appropriate. The EPCs will be presented in RAGS tables titled, "Medium-Specific Exposure Point Concentration Summary." The EPCs will represent the lesser of the maximum detected concentration or the calculated upper confidence limit (UCL) for the arithmetic mean concentration. The UCL will be calculated using the statistical methods, as recommended or approved by EPA Region 2. The data distribution for each COPC will be determined and a UCL concentration will be selected.

The exposure parameters for the proposed scenarios will be presented in RAGS tables, "Values Used For Daily Intake Calculations." They will represent EPA's Reasonable Maximum Exposure (RME) scenario in order to facilitate risk management issues. Relevant equations for assessing intakes and exposure factors will be obtained from RAGS Part A (USEPA, 1989), Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry (USEPA, 1994), EPA's Exposure Factors Handbook (EFH) (EPA, August 1997), and EPA's most recent guidance on assessing risks to dermal exposures presented in RAGS Part E (EPA, August 16, 2004). CT scenarios will be evaluated if the risk estimates exceed EPA's acceptable target risk criteria. The RME case will generally be based on default exposure factors and 95th percentile exposure values from the EFH (EPA, 1997a). The CT case will generally be based on the standard default exposure factors (EPA, 1991) and, where appropriate, the 50th percentile exposure values from the EFH (EPA, 1997a). Bioavailability of all constituents will conservatively be assumed to be 100 percent.

Fate and transport modeling (e.g., modeling particulate and volatile emissions from soil and modeling VOC release during showering) will be considered with EPA R2 as additional site reconnaissance information and data are assessed and become available. No modeling is included in the budget estimate at this time. It is understood that indoor air vapor intrusion pathway assessment is being conducted by EPA R2, and data obtained from the EPA WAM will be incorporated into the BHHRA.

Toxicological Evaluation

The COPCs will be evaluated based on their intrinsic toxicological properties as either non-carcinogens (i.e., systemic toxicants) or carcinogens. Quantitative toxicity indices that describe the relationship between exposure resulting in a calculated dose (concentration x chemical intake), and the likelihood of that exposure to result in adverse health effects (response), will be selected for use in the BHHRA. For non-carcinogens, the toxicity indices are reference doses (RfDs) or reference concentrations (RfCs). For carcinogens, the toxicity indices are cancer slope factors (CSFs). Toxicity data for the selected COPCs will be obtained from the EPA with the

following hierarchy of sources: EPA RSL Table (most up-to-date version); the Integrated Risk Information System (IRIS) database (EPA, 2005), EPA's Provisional Peer Reviewed Toxicity Values (PPRTVs), other toxicity values, including the Health Effects Assessment Summary Tables (HEAST) (EPA, 1997b).

Oral RfDs and CSFs are typically based on administered dose (i.e., oral or inhalation exposure routes). The methodologies for evaluating dermal absorption are based on an estimation of absorbed dose. Therefore, for evaluating dermal exposures, oral toxicity factors will be adjusted to represent an absorbed rather than an administered dose. Consistent with the EPA guidance on dermal risk assessment (EPA, 2004d) and in consultation with EPA Region 2, an adjustment will be made when the following conditions are met:

- The toxicity factor from the critical study is based on an administered dose; and
- A scientifically defensible database demonstrates that the gastrointestinal absorption of the chemical is significantly less than 100% (i.e., 50%).

If these conditions are not met, no adjustment will be made and a default value of complete (i.e., 100%) absorption will be conservatively assumed.

3.2 Task 2 - Community Relations

HDR will provide community involvement support to EPA throughout the RI/FS in accordance with the document, "Superfund Community Involvement Handbook" (EPA, April 2005) and direction from the EPA WAM.

3.2.1 Community Interviews

In preparing for community interviews, HDR will review background documents and make arrangements for, and provide technical support to, EPA during the conduct of community interviews with appropriate government officials (federal, state, county, town, village, etc.), environmental groups, school district personnel, and any other relevant individuals or groups in person or via telephone. Draft interview questionnaires will be prepared and submitted to EPA for review and comment. Final interview questionnaires will incorporate comments from EPA. HDR will assist EPA during the interviews and will summarize information gathered for inclusion in the Community Involvement Plan (CIP).

For budget estimate purposes, a total of 130 interviews are assumed to be conducted by HDR (this value assumes approximately 5% of the 2,600 households in Hewlett, New York). HDR will compile contact information for potential interviewees based on existing information provided by EPA (i.e., list of participants from previous EPA outreach activities), and attempt to conduct one of the following types of community interviews:

- Telephone interviews (50%, or 65 phone interviews assumed);
- Pre-arranged on-site interviews (25%, or 33 in-person interviews assumed); or
- Door-to-door surveys (25%, or 33 door-to-door, in-person interviews assumed).

3.2.2 Community Involvement Plan

HDR will develop a Draft and Final CIP that will include the following elements:

- Overview of Community Involvement Plan;
- Site Description (site background including location, description, and history);

- Community Overview (community profile, chronology of community involvement, and key community concerns);
- Community Involvement Program Highlights (general objectives);
- Community Involvement Program Techniques (planned activities and schedule);
- Attachment A - Contacts and interested parties (mailing list);
- Attachment B - Information Repositories and Public Meeting Locations (name and address of the information repositories and public meeting facility locations; including Hewlett Woodmere Public Library);
- Attachment C - List of acronyms; and
- Attachment D - Glossary.

The CIP will incorporate existing contacts and interested parties, as received from EPA (i.e., from previous community interactions) and available from NYSDEC (i.e., 2003 community outreach efforts as part of the Grove Cleaners PRAP).

3.2.3 Public Meeting Support

HDR will make arrangements for three (3) public meetings/availability sessions/open house including the selection and reservation of the meeting space. It is understood that an assembly space will be made available (free of charge) at the local high school. Two HDR personnel (including the Project Manager) will participate at the public meetings or availability sessions. HDR will prepare meeting presentation materials/handouts; prepare and maintain sign-n sheet to record attendees; provide and operate slide show projector / laptop; provide and operate audio visual recording equipment for documentation purposes; and prepare draft and final meeting summaries to EPA following the meetings.

Draft meeting presentation/visual aids (i.e., slides and handouts) will be prepared by HDR prior to each meeting. Final handouts (1 page, double-sided assumed) and slides to be utilized at the meetings will incorporate all EPA comments. The budget estimate for this task assumes 20 power point slides and 200 handouts per each meeting. It is assumed that a stenographer will not be necessary. A full page original of the handout, "four on one page" copy of the slides (hard copy and electronic formats), and a copy of the audio visual recordings (DVD) will be provided to EPA following each meeting for documentation purposes.

Each meeting is estimated as 4 hours duration plus 3 hours travel time. In addition, the costs include 1 hour before and after the meeting for set-up and post-meeting activities. If HDR is to assume an active presentation role at one or more meetings, the estimated level-of-effort and presentation content will be discussed with the EPA WAM and Community Involvement Coordinator (CIC) in advance. Chairs, tables, projection screen, and other required furniture / equipment is assumed to be available in the meeting room at no cost.

3.2.4 Fact Sheet Preparation

Draft fact sheets (letters/updates/fact sheets) for the Site will be prepared by HDR at the direction of EPA's WAM. HDR will research, write, edit, design, layout and reproduce the fact sheets for EPA review. Final fact sheets will be produced based on EPA comments. HDR will prepare mailing labels (based on the current contact list) prior to delivery to EPA. The level-of-effort for this subtask assumes a total of four (4) fact sheets (1 fact sheet to be distributed before or after each public meeting, plus 1 additional fact sheet during the project period). The fact sheets are anticipated to be 2 to 4 pages in length (double-sided, black and white print), with up to 3 illustrations. All fact sheets will be written in English (i.e., Fact Sheets in secondary language(s) are not included in this scope).

3.2.5 Proposed Plan Support

HDR will provide administrative and technical support to the WAM for the preparation of the draft and final Proposed Plan. The Plan will describe environmental conditions at the Site (i.e., RI findings summary); the preferred remedial alternative and other alternatives evaluated in the Feasibility Study; any waivers to cleanup standards; formal comments received from the support agency; and describe opportunities for public involvement in the Record of Decision. The plan will be prepared in accordance with EPA's Superfund Community Involvement Handbook (April 2005).

HDR will also prepare graphic materials and/or maps that may be included in the Proposed Plan. The graphics will be based on those created for the RI/FS. The Proposed Plan will be published in 8.5 x 11 inch size format (comprised of 11 x 17 inch paper folded in half.) It will consist of a card stock cover (EPA may choose from a number of available colors) and will contain approximately 24 double-sided pages including graphics. The plan will be bound in a book-type format using staples placed along the central spine. HDR will produce 275 copies of the final Proposed Plan for distribution by EPA. The Proposed Plan will be published in English.

3.2.6 Public Notices

Four newspaper announcement/public notices will be prepared, three to announce each of the three public meetings and a fourth to be prepared and published at the discretion of the EPA WAM. Three notices will each appear in two newspapers (one local large circulation and one local small circulation) to inform the public about upcoming public meetings. The fourth notice will appear only in a small-circulation newspaper. The notices will be prepared in English, and be submitted to EPA for review prior to placement in the newspapers.

As noted above, HDR will look to develop lists of contacts and work with key groups in the site area (i.e., citizen groups, school board or political representatives, local government, chamber-of-commerce / business advocates, Long Island Rail Road [LIRR] contacts, etc.) to increase public awareness on the RI/FS activities. Any needs for further outreach, or benefits in preparing community relations documents in other languages, will be communicated to EPA.

3.2.7 Information Repositories

HDR will provide the documents to update the Information Repositories to the EPA WAM or Community Involvement Coordinator (CIC), as directed. EPA R2 will ensure that the repositories are updated. It is assumed that the existing repository (Hewlett Woodmere Public Library, 1125 Broadway, Hewlett, New York [516-374-1967]) will continued to be used as the local repository. The USEPA Pre-Remedial File Room (290 Broadway, 19th Floor, New York, New York) will also be used as a project repository.

3.2.8 Site Mailing List

HDR will update the mailing list for community involvement activities for the Site. The cost assumes that the mailing list will be updated three times (following each public meeting) and that each mailing list will consist of approximately 250 entries. HDR will provide an electronic version of the mailing list and mailing labels for each mailing. Actual mailing of any information to the community will be performed by EPA.

3.2.9 Responsiveness Summary

HDR will provide support to EPA on efforts to compile a responsiveness summary that presents significant oral and written comments that EPA receives during the public comment period on the Proposed Plan and Feasibility Study. Based upon discussions with EPA, no deliverable is required as part of this subtask.

3.3 Task 3 – Field Investigation

HDR's field investigation will begin after access to properties for well installation has been arranged by EPA, and end with the demobilization of field personnel and equipment from the site following completion of the remedial investigation. The field investigation will consist of a detailed hydrogeological assessment, a soil boring program (for well installation), and field sampling to further evaluate the extent of the groundwater contaminant plume, attempt to identify sources of PCE contamination, further determine fate and transport of site contaminants, support the ecological and human health risk assessments, and support the Feasibility Study.

The field investigation proposed consists of the installation of six monitor wells, collection of soil samples at the six monitoring well locations, and gauging / sampling groundwater at the six new monitoring wells and twenty existing monitoring wells. Permeability or slug testing, pilot testing, or treatability studies are not included in this scope of work.

Based on RI field investigation findings or observations, HDR may recommend additional or supplemental investigative work. As noted prior, any modification to the approved Work Plan will require EPA notice-to-proceed prior to implementation. HDR will prepare technical memoranda with rationales supporting recommendations for any out-of-scope for EPA review.

3.3.1 Mobilization and Demobilization

Mobilization activities will be required to support the activities to be performed during the field investigation. During mobilization, all the necessary equipment and materials will be procured and transferred to the Site. The necessary personnel, equipment, and materials for conducting the field activities will be assembled during mobilization.

During mobilization, it is assumed that installation and setup of utilities and temporary facilities (i.e., site trailer, phone, electric, bathroom facilities, etc.) will not be required. Establishment of temporary equipment decontamination and IDW storage areas will be required, however. It is currently anticipated that project-related equipment staging will occur in an area in the vicinity of the Site to be selected by EPA and HDR. HDR will attempt to coordinate staging with the Inwood Department of Public Works (DPW), as has been arranged during prior EPA-led investigation work.

As noted above, field survey and site reconnaissance work is anticipated to be conducted during the mobilization phase of the project (i.e., pathway analysis reconnaissance).

3.3.1.1 Sewer System Investigation

Information regarding the storm and sanitary sewer lines will be pursued from local municipal / governmental contacts. The locations of the storm and sanitary sewer lines, as well as storm drains, will be plotted on a map of the Site. Locations of these lines will be evaluated for the potential of the pipes (or the bedding material around the pipes) and drains to serve as a preferential pathway for contaminant migration from source areas.

3.3.1.2 Well Inventory

An assessment of existing monitoring wells (e.g., from TtFW's previous work) and on-site residential, commercial, and water supply wells will be conducted during the Site Reconnaissance. During August 2009, HDR acquired from the USGS a compilation of records for public water supplies in the vicinity of the site using New York State Department of Environmental Conservation's Public Supply Well database and the USGS Groundwater Site Inventory (GWSI) and National Water Information System (NWIS) database. These records provide the coordinates, water bearing aquifer, drilled depth, and screened interval for public water supply wells in the vicinity of the Peninsula Boulevard site. These data will be used to assist in further evaluating the potential pumping impacts on the surrounding aquifers and resultant migration of the contaminant plume, specifically with respect to hydraulic connection and potential vertical migration within the UGA – Jameco – Magothy system.

HDR will attempt to coordinate a meeting with LIAW representatives for purposes of collecting information on the nearby supply wells (Plant 5 Well Field) to supplement the available data from USGS. HDR will collect and review data pertaining to well location, construction, depth, screened intervals, yield, and other parameters that can be used for the hydrogeological assessment. The locations of the LIAW wells – and any other commercial, industrial, residential, or other public use wells identified in the area - will be plotted on groundwater contaminant isoconcentration maps prepared for the Site to illustrate the relationship of existing groundwater use to any site-related groundwater contamination. The potential influence of water withdrawal from these wells on groundwater flow directions at the Site will also be considered.

For the proposed RI work, it is assumed that the existing monitoring wells installed by TtFW and designated for sampling are in satisfactory condition and can be sampled. No separate well inspection task for these wells is assumed.

3.3.1.3 Property Access

HDR will work with the surveying subcontractor to obtain and review tax maps of the Site area. A list of properties for which access is needed for the Field Investigation activities will be provided to EPA. It is understood that EPA will coordinate access to the properties to facilitate the Field Investigation.

3.3.1.4 Geophysical Survey and Utility Markouts

A mark out of underground utilities will be performed within the Site to guide the placement of soil borings. The drilling subcontractor will request a regular utility markout (locate) from the New York Dig Safe center, and provide documentation (i.e., confirmation ticket numbers) to HDR. A regular locate is performed when intrusive activities will begin no sooner than three business days after the request is made and no later than ten business days after the request is made. The locate is assumed valid for 30 business days. A new locate request must be made prior to the expiration of the initial request when intrusive activities are planned that will continue beyond the 30 business day approval. The Dig Safe center notifies appropriate utility companies to mark the location of all their known utilities within the Site.

A surface geophysical survey will be conducted by the subcontracted geophysical survey firm at the six proposed soil boring / monitoring well locations. The primary objective will be avoidance of subsurface utilities during drilling activities. A 100-sf area around each soil boring/monitoring well location will be surveyed and any utilities detected will be marked out. Several geophysical techniques will be used to clear each drilling location. The following list provides the three methods that will be used at a minimum:

- Precision Utility Locator; and

- Ground Penetrating Radar.

The following uniform color code will be utilized for staking and marking used to designate the location of underground facilities and excavation sites:

- Yellow - Gas, oil, petroleum products, steam, compressed air, compressed gases and all other hazardous liquid or gaseous materials except water;
- Red - Electric power lines or conduits;
- Orange - Communication lines or cables, including but not limited to telephone, telegraph, fire signals, cable television, civil defense, data systems, electronic controls and other instrumentation;
- Blue - Water; and
- Green - Storm and sanitary sewers including force mains and other non-hazardous materials.

It is anticipated that the cultural features, debris and the proximity of the drilling to utilities at the Site may likely result in complicated geophysical signatures for a number of locations, making interpretation difficult. Therefore, soil boring locations will be hand cleared to at least 4 feet.

The results of the geophysical survey, including a description of the data collected, will be included in the RI Report.

Upon completion of the field investigation, demobilization will occur. The following activities will be performed:

- Complete site restoration activities;
- Arrange for the transportation and disposal of wastes, including IDW and decontamination related equipment and materials from the staging area(s); and
- Return surplus expendable equipment to HDR warehouse.

3.3.2 Hydrogeologic Assessment

The mechanism of groundwater contaminant transport through the overburden (movement through sedimentary materials of varying hydrogeologic properties) must be characterized to provide the basis of the risk assessments and feasibility study in order to develop an effective remedial program for the site. The hydrogeological assessment will include the coordination of the installation of 6 monitoring wells to supplement the existing monitoring well network. These activities will be performed by a subcontractor and will be overseen by an HDR geologist (see below Section 3.3.3).

The purpose of the hydrogeological assessment is to:

- Identify additional source areas;
- Further characterize the horizontal and vertical extent of groundwater contamination – particularly in the semi-confined portion of the Upper Glacial Aquifer (UGA).
- Sufficiently characterize groundwater flow and contaminant migration pathways to develop remedial alternatives for mitigation of site impacts and evaluate risks to the environment
- Identify potential recharge and discharge zones in the aquifer based on assessment of vertical hydraulic gradients.

Rationale for the proposed groundwater monitoring well installation locations is provided in Table 2 and a diagram depicting the proposed well locations is provided as Figure 5. The locations presented are tentative and

will be finalized based on utility clearances, geophysical survey, and the ability to gain access to the properties / rights-of-way (ROWs).

The hydrological assessment is anticipated to continue throughout the RI, to assess new data as it becomes available (i.e., USGS, LIAW, and other sources). The SCM for groundwater will be periodically updated under this task. Note that hydrogeological computer modeling and aquifer testing (slug tests, pump tests) are not included in the WP.

3.3.3 Soil Borings, Drilling, and Testing

Six (6) monitoring wells (designated as MW-24, MW-25, MW-26, MW-27, MW-28, and MW-29) will be installed throughout the Site to evaluate groundwater quality and to provide hydrogeologic flow data, particularly in the shallow and semi-confined portions of the UGA above and below the "20-foot clay". The 6 monitoring wells will be installed to an approximate maximum depth of 70 feet below grade. Four of the wells will be installed with multi-level screens to assess the groundwater at approximately 25-ft and 60-ft bgs in the same borehole. See Figures 6 and 7 for typical multi-level well. The additional two wells will be constructed as standard monitoring wells screened just above the deep confining layer formed by the Gardiners clay.

Monitoring well boreholes will be drilled using hollow-stem auger methods. Soil samples will be collected by continuous split-spoon sampling until target depth is reached. The subsurface lithology will be logged by a HDR geologist according the Unified Soil Classification System (USCS) and modified Burmeister methods. Soil recovered from the split spoons will also be field screened using a photoionization detector to detect the presence of volatile compounds. All PID responses and observations on the nature of the recovered material (i.e. staining, odor, saturation) will be noted by an HDR geologist on a drilling log or field book. It is assumed that up to two soil samples will be submitted for laboratory analysis from each boring (12 soil samples total).

The two standard monitoring wells will be constructed with polyvinyl chloride (PVC) riser and screen inside the hollow-stem augers. Upon completion of the borehole to the desired depth, the monitoring well will be installed using 2-inch ID, flush joint, schedule 40 PVC. These monitoring wells will be installed with 10 feet of 2-inch ID 0.010 inch (No.10) slot PVC screen with a bottom cap at the base and 2-inch PVC riser to the surface. Centralizers will be placed on the riser to ensure that the well is positioned properly in the boring. A slurry of graded sand will be tremied down the annulus of the borehole to an elevation of approximately 2 feet above the top of the screen interval to form a sand pack. A bentonite slurry will be tremied down the annular space to form a 3-foot thick bentonite seal above the sand pack. The remaining annular space will then be tremie grouted with a cement-bentonite grout to within 2 feet of the ground surface.

The four wells designated with multi-level screens will be drilled using the same hollow-stem auger method employed for the standard wells; however, installation of the well screens and riser will utilize methods and materials such as the Continuous Multichannel Tubing™ (CMT) system from Solinst. See Figure 7 for typical CMT cross-section. The CMT system is comprised of HDPE tubing that has been extruded with seven discrete channels within the outer wall of the tubing. By slotting the outer wall of the tubing at points corresponding to the desired screen depth (slotted at one interval per channel), the discrete channels effectively form a narrow well riser hydraulically connected to the aquifer at the depth at which the slots are cut. The slotted intervals are typically wrapped with a stainless steel screen secured to the tubing with stainless steel hose clamps. Since only two widely separated screened intervals will be used over the entire depth of the proposed wells, traditional well installation methods are adequate to insure transmission of water between the aquifer through a filter pack of graded sand and sealing of the borehole between screened intervals using a thickness of coated bentonite pellets. Alternate methods of installing the CMT system are available to guarantee isolation of the screened intervals. These methods, utilizing pre-packed sand packs and bentonite packers attached along the length of tubing

corresponding to the required depths can be implemented as field conditions dictate. (Einarson & Cherry, 2002) (Solinst telcon 8-17-09)

Based on HDR's analysis, the CMT method appears to be preferred for the four wells designated to have multi-level screens. The objective for these wells is to provide sample access to zones above and below the "20 ft clay" layer, so that groundwater quality and flow patterns can be better assessed at the site. The depth interval placements and lengths of CMT screening will be determined in the field based on the soil borings at each location. CMT tubing with seven channels will be specified for the well installations, as it will be able to accommodate contemplated groundwater sampling methods (Teflon tubing with low flow bladder pump). The seven channel tubing has a 1.7" total tubing diameter, with center circular channel of 3/8" (0.375") diameter and the six surrounding channels each with 10 millimeter (0.4") diameter. Since the CMT channels do not come with pre-cut slots but are instead manually slotted in the field, the depth and interval of the effective screened area can be developed in response to field observations during the drilling of the well.

Although two general depth intervals are targeted for sample collection (and thus only two CMT channels are required), more than one channel may be used for a given depth interval. By providing this redundancy, the CMT method could increase the success of sample collection at a desired depth in the case where one of the channels encounters smearing due to clay or has poor yield. Alternatively, the "extra" channels may be dedicated to water level measurements or in-situ chemistry measurements at the same depth in the aquifer. Further, if field observations suggest that an additional monitoring zone would be beneficial (i.e., immediately below 20 ft clay; suspected DNAPL area), unused channels within the CMT can be designated to include the additional screened interval (s).

Utilizing the CMT system allows greater real-time flexibility in well construction to respond to findings during the drilling of the boreholes. The installation of CMT tubing can be more cost effective than drilling multiple boreholes for a well cluster, and the installation of sand filter packs and bentonite seals for isolating specific zones within the aquifer is more straightforward than with traditional methods of installing nested wells in a common borehole. This is especially a consideration in situations where the desired range of vertical separation between screened zones is relatively small, thereby requiring precise installation of the filter pack and the bentonite seal to insure adequate connection between the aquifer and screened zone while preventing vertical migration between the screens within the potential pathway formed by the borehole. (Einarson & Cherry, 2002)

In some situations, CMT may not be the most suitable method for well installation, particularly in cases where the yield of the formation is low and the relatively small screen area for a given CMT channel impedes adequate recharge into the tubing or where a larger diameter well is required for in-situ hydraulic testing or higher volume sampling where insertion of larger transducers or pumps into the wells may be necessary. The presence of clay confining or semi-confining layers such as the Gardiners clay and the 20-foot clay are also a concern when using CMT since the hollow stem augers through which the CMT is installed must be direct-pulled rather than rotated for removal from the borehole. Clay layers can lock the augers in place at depth and, although significant penetration into the Gardiners clay is not anticipated, there is the potential that the relatively thick portion of the 20-foot clay would make direct-pulling the augers difficult, despite the relatively shallow depth of the layer. Of greater concern with respect to the clay layers is the possibility that some smearing could occur across the relatively narrow discrete screened intervals of the CMT as the augers are removed from the borehole, particularly if the screened intervals are just above clay layers (Delta Well & Pump telcon, 8-17-09). In the event that either of these scenarios results in excess time or effort being expended to set the CMT wells, the alternate method of installing nested 1-inch PVC wells within a common borehole will be employed. Figures 6 and 7 depict schematic representations of wells set using a standard nested well and the CMT system, respectively.

All monitoring wells will be completed with flush mount protective casings set into concrete / asphalt and will be developed by the drilling subcontractor no sooner than 48 hours but no longer than 2 weeks after completion. Development water will be appropriately handled and staged with other IDW.

Site Survey

The existing Peninsula Boulevard Groundwater Plume site base map will be enhanced by a New York State licensed survey subcontractor utilizing industry standard methods (GPS, aerial photography etc.). The locations of the six new wells will be integrated on a common base map that includes the existing wells installed by TtFW. A consistent coordinate system using the North American Datum of 1983 (NAD 83) as the horizontal control and the North American Vertical Datum of 1988 (NAVD 88) as the vertical control will be utilized. The base map will be obtained in both sealed hard copy and the AutoCAD electronic format from the survey subcontractor. The AutoCad format will facilitate the incorporation of site survey information into the project Geographic Information System (GIS).

The local tax assessor's office will be contacted if needed to obtain property tax maps for the plume area, and utility rights-of-way. Other utility information will be obtained from municipal and county authorities.

Groundwater Elevation Measurements

Synoptic groundwater elevation measurements will be collected during each sampling round from a subset of the existing wells installed by TetraTech and the proposed new wells to provide a representative survey of groundwater levels in the unconfined and semi-confined portions of UGA. One sampling round of the six new monitoring wells is planned upon completion of the monitoring well network. One additional sample round (six new wells plus twenty existing monitoring wells in the network) will also be conducted. The objectives of measuring groundwater elevations are:

- Determine groundwater flow direction under seasonal conditions;
- Collect sufficient data to prepare groundwater elevation maps and evaluate flow direction;
- Evaluate the potential for impacted groundwater discharge into surface water bodies;
- Further refine the identification of vertical gradients between the shallow and deep portions of the UGA and assist in delineating the extent of semi-confined conditions within the aquifer; and
- Develop SCM for impacted groundwater in the unconfined and semi-confined portions of the UGA.

All data will be recorded and presented in tabular form. Groundwater elevations will be measured from the surveyed inner casing measuring point using an electronic interface probe.

3.3.4 Environmental Sampling

In order to obtain a current understanding of groundwater conditions at the Site, two (2) rounds of groundwater samples are proposed to be collected from the six new monitoring wells (MW-24, MW-25, MW-26, MW-27, MW-28, and MW-29) and one round of groundwater samples will be collected from the 20 wells installed by TtFW (MW 10S, MW-10D, MW-11, MW-12, MW-13S, MW-13D, MW-14, MW-15S, MW-15D, MW-16, MW-17, MW-18S, MW-18D, MW-19, MW-20, MW-21S, MW-21D, MW-22S, MW-22D, and MW-23). The wells will be purged in accordance with the EPA Region 2 Low Stress Method. The groundwater samples will be screened in the field for indicator parameters (pH, temperature, specific conductivity, dissolved oxygen, turbidity and Eh) using an in-line flow cell. The purpose of this sampling is to further characterize the nature of the plume.

Groundwater purging operations and subsequent groundwater sampling will be conducted using an adjustable-rate stainless-steel bladder pump or submersible pump equipped with dedicated teflon tubing and a flow-through cell. Prior to sampling, a water level measurement will be recorded using an electronic water level indicator. These measurements are taken cautiously to the extent practicable, in order to cause minimum turbulence to the static water level. After the water level is recorded, groundwater in each monitoring well will be purged. The groundwater purging will be accompanied by the periodic measurement of field indicator parameters, including pH, temperature, specific conductivity, dissolved oxygen, turbidity, and oxidation-reduction potential (Eh) using a flow-through cell attached to the teflon tubing. Once the field parameters are considered to be stabilized within the limits specified in the EPA's Low Stress Method, groundwater samples will be collected directly from the teflon tubing into sampling vials/jars. The purged groundwater and the well headspace will also be field-screened using a PID.

Purge waters will be appropriately handled and staged with other IDW, pending waste classification and disposal.

HDR will implement QAPP procedures and perform activities necessary to ensure the proper management of samples, including implementation and execution of accurate chain-of-custody procedures and other applicable requirements for sample tracking, protective sample packing techniques, and proper sample preservation techniques. HDR will prepare and maintain daily quality control reports (DQCR) during the duration of the field investigation.

3.3.5 Investigation Derived Waste Characterization and Disposal

HDR will assist the EPA in arranging for a secure location to stage the IDW. It is anticipated that the Inwood DPW yard is a viable option for temporary IDW storage. Prior to generating IDW, a plan will be developed and communicated by HDR to all relevant parties (subcontractors, property representative, EPA). The plan will describe the proposed methods of management of IDW generated during the field investigation (including staging pad, fencing, tarping, marking, and inspection requirements). All consumables not contaminated by site contaminants or hazardous materials will be disposed as conventional municipal solid waste. IDW will include the following waste streams:

- Monitoring well development and purge water;
- Soil cuttings;
- Decontamination fluids containing wash/rinse water and decontamination chemicals; and
- Contaminated debris including but not limited to personal protective clothing, plastic sheeting, and consumable sampling equipment.

IDW determined to be hazardous will be transported by an approved, licensed transporter (under subcontract to HDR) to an approved treatment, storage, and disposal facility for disposal. HDR will collect waste classification samples, and submit to DESA for analyses. HDR will submit the data to the IDW subcontractor, and review the subcontractor's profiles, manifests, and recommendation for a classification and a facility. The IDW subcontractor's recommendations will also be forwarded to EPA for concurrence and approval.

3.4 Task 4 – Sample Analysis

HDR will arrange for the analysis of environmental samples collected as Part of Task 3.0. All samples are to be analyzed by Division of Environmental Science and Assessment (DESA) and it is assumed that HDR will not incur any analytical costs associated with this task. It is anticipated that groundwater and soil samples collected during the investigation work will be analyzed for low-level VOCs using Method SOM01.2. The required

analytical parameters for IDW classification will depend on the IDW subcontractor disposal options; HDR will submit the analysis list to DESA when final.

3.5 Task 5 – Analytical Support and Data Validation

The HDR Project Manager will arrange with EPA sample management personnel for the analysis and validation of environmental samples collected during the field investigation program in accordance with the EPA Technical Memorandum "Procuring Analytical Services through the DESA Laboratory and the CLP" (EPA, undated). Sample analysis will be performed by the EPA Region 2 DESA Laboratory and/or CLP and will be scheduled with the EPA Regional Sample Control Center (RSCC) office in Edison, New Jersey.

Validation of data generated using Tier 1 and Tier 2 of the Field and Analytical Services Teaming Advisory Committee (FASTAC) strategy will be performed by EPA R2.

3.5.1 Collect, Prepare and Ship Environmental Samples

During the field investigation, HDR will collect, prepare and ship all samples collected under Task 3 in accordance with approved QAPP. A summary of the field samples and associated QA/QC samples to be collected is provided in the QAPP. For samples to be analyzed by the DESA Laboratory and/or CLP laboratories, HDR will procure and provide the sample containers. Arrangements will be made for sample shipment and delivery schedules with the RSCC. [In the event that a subcontract laboratory is required during the field investigation, the sample containers will be provided by the non-DESA/CLP laboratory, and arrangements for container delivery and shipment will be made directly with the subcontractor laboratory.]

3.5.2 Sample Management

HDR will provide a sample management plan that includes:

- Coordinate with RSCC, and/or DESA regarding analytical, data validation, and quality assurance issues.
- Prepare trip report for all samples that will be analyzed by the CLP.
- Provide Chain of Custody, Sample Retention, and Data Storage functions in accordance with the approved contract wide QAPP, QMP and contract. HDR will ensure accurate chain-of-custody procedures for sample tracking, protective sample packing techniques and proper sample preservation techniques.

3.5.3 Data Validation

DESA and CLP RAS generated data will be validated by EPA Region 2 personnel. Data packages will be sent to the EPA WAM, who will forward a copy of the validated results to HDR.

3.6 Task 6 – Data Evaluation

This task includes the compilation and evaluation of HDR's field sampling data, and an evaluation of the usability of the data. A Data Evaluation Report (DER) Addendum will be prepared that summarizes the results (solely) of HDR's RI investigation. The report will include a discussion of the investigation activities, the analytical results, and any apparent trends and/or discrepancies within the data. The DER will also identify additional data requirements, if warranted, and present rationales for the value of supplemental data to the RI/FS.

3.6.1 Data Usability Evaluation

HDR will evaluate (quantitatively and/or qualitatively) the usability of data obtained during this Work Assignment's investigatory phase by:

- Examining data validation summary reports and field logbooks, and verifying that the sampling procedures and analytical results were obtained following the applicable protocols;
- Verifying that the data is of sufficient quality to satisfy DQOs and can be relied upon for performing the Risk Assessments, the Feasibility Study, and subsequent remedial design activities.

If statistical methods are used to evaluate the usability of the data, the evaluation will be performed in accordance with Data Quality Assessment: A Reviewer's Guide EPA QA/G-9R EPA/240/B-06/002, February 2006. The results of the data usability evaluations will be presented in the DER.

3.6.2 Data Reduction, Tabulation and Evaluation

Validated data assessed to be usable and relevant to the project will be compiled and summarized in tabular format with an independent quality control verification to prevent transcription/typographical errors.

For reporting purposes, tables of analytical results will be organized by analytical fraction (e.g., VOCs, field chemistry, etc.), matrix (e.g., soil or groundwater), and/or segregated according to specific contaminant source area and/or other unique areas, if warranted. Analytical tables will identify individual samples by a unique sample location/identification number that corresponds to the sample location maps. The tables will also include the sample collection dates, detection limits for parameters not detected, and laboratory and/or data validation qualifiers. Standard units for results reporting (e.g., micrograms per liter (ug/L) for organics in groundwater) will be used in all tables, texts and figures which summarize the analytical results. Protocol for eliminating field sample analytical results based on laboratory/field blank contamination results shall be clearly explained.

Graphical soil boring logs/well construction diagrams will be prepared during the data reduction phase to describe the subsurface conditions encountered during intrusive operations. Soil interval information will be used in generating cross-section figures.

3.6.3 Data Evaluation Report Addendum

A DER Addendum, in the form of a Technical Memorandum, will be prepared and submitted to the EPA for review and approval within 30 days after completion of Subtask 6.2. This report will include:

- A discussion of HDR's investigation activities;
- A summary of the results of HDR's field effort;
- A determination of the usability of the data obtained during HDR's investigation;
- An assessment of ability of the data to satisfy DQOs;
- A discussion of any apparent trends in HDR's data;
- Refinement of the SCM, which will be continually reviewed and modified (as needed) during the RI;
- Additional data requirements, if warranted (i.e., recommendations and rationales for potential subsequent field investigation work, aquifer tests, or modeling);
- Soil boring logs/monitoring well diagrams; and
- Tables of the analytical data acquired during HDR's field program (no historic data will be included in the Data Evaluation Report Addendum);

- Electronic submittal of field sampling and laboratory analytical results, geologic data, and well and location data in accordance with the EPA's "Comprehensive Electronic Data Deliverable Specification Manual 1.4", July 2009.

Within the DER Addendum, the EPA protocol for eliminating field sampling analytical results based on laboratory/field blank contamination results will be clearly explained. The discussions of the sampling results will not be qualified by suggesting that a particular chemical is a common laboratory contaminant or was detected in a laboratory blank. If the reported result has passed QA/QC, it will be considered valid. Field rinsate blank analyses will be discussed in detail in the DER if decontamination solvents are believed to have contaminated field samples.

After submission of the DER Addendum, EPA and HDR will meet to discuss the report contents. It is assumed that a revised DER Addendum will not be necessary; however, a response to comments and minutes of discussions will be developed. Any changes to the information provided in the DER Addendum based on the comments/discussion will be incorporated into the Draft RI Report. If a significant data gap is identified, HDR may recommend supplemental field work prior to preparing the RI reports.

3.7 Task 7 – Risk Assessment

3.7.1 Baseline Human Health Risk Assessment

HDR will evaluate and assess the current and potential future risk to human health posed by exposure to soil (surface and subsurface), groundwater, sediment, surface water, and air contaminants identified at the Site (as noted, it is understood that indoor air vapor intrusion pathway assessment is being conducted by EPA R2, and data obtained from the EPA will be incorporated into the BHHRA). The BHHRA will incorporate the information / methodologies presented in the Draft PAR along with information added or modified in response to EPA comments. Development of the BHHRA report is contingent on the approval of the PAR by EPA Region 2.

The BHHRA report will be prepared in accordance with the following EPA guidance documents: RAGS Parts A, D, and E (EPA, 1989, 2001, and 2004d, respectively) and the Exposure Factors Handbook (EPA, 1997) and guidance provided by EPA Region 2. The following subsections present the principal elements to be addressed in the Draft and Final BHHRA reports.

Draft Baseline Human Health Risk Assessment Report

The BHHRA will address the following as described in the PAR:

BHHRA Conceptual Site Model - The cumulative analyses and results are synthesized to develop an overall model of the potential exposures and risks to the contaminated site media.

Hazard Identification - Identifying which hazardous substances are present in the Site media and which constitute the major COPCs due to potential exposures. Data from all historic sampling events (EPA, NYSDEC, other agencies if available) and data generated from HDR's field investigation will be considered for use in the BHHRA.

Characterization of Exposure Setting - Identifying and characterizing the human populations and exposure pathways (part of the Conceptual Site Model).

Exposure Assessment - Identifying the magnitude of actual or potential human exposures, the frequency and duration of these exposures, and the routes by which these receptors are exposed. The exposure assessment will include an evaluation of the likelihood of such exposures occurring and will provide the basis for the development of acceptable exposure levels. Reasonable Maximum Exposure (RME) estimates of exposure (and Central Tendency [CT] estimates, if required) for both current and potential future use of the Site will be developed.

Toxicological Evaluation - Evaluating and characterizing the intrinsic toxicological properties of these COPCs.

Further, the BHHRA report will address the following aspects not previously described in the PAR:

Risk Characterization - Combining contaminant-specific toxicity information with quantitative and qualitative information from the exposure assessment to develop estimates of risk that can be compared to EPA target levels established to indicate when site chemicals may potentially affect human health. The risk projections will be presented and interpreted with respect to naturally occurring compounds and which indicated risk drivers may justify remediation. The results will allow a separate evaluation of each exposure area to facilitate site management decision-making.

Identification of Limitations/Uncertainties - Critically evaluating the principal assumptions and uncertainties in the BHHRA or in the interpretation of the results.

These two elements of the BHHRA (not addressed in the PAR) are described in greater detail below.

Risk Characterization

Chemical-specific toxicity information will be combined with quantitative and qualitative data from the exposure assessment presented in PAR. Collectively, this information will be used to calculate non-carcinogenic and carcinogenic risks for individual receptors and exposure routes identified in the BHHRA Conceptual Site Model.

The operative EPA model for dose-response of non-carcinogenic COPCs assumes that a minimum threshold dose or intake exists below which adverse effects are not associated with exposure. Therefore, the potential for non-carcinogenic effects is calculated by dividing the chemical-specific chronic daily intake (CDI) by the reference dose (RfD) for each COPC. The resulting quotient or ratio is the hazard quotient (HQ) and is calculated for individual COPCs. HQs will be summed over all chemicals and all complete exposure pathways to estimate a cumulative hazard index (HI) for each receptor and will be presented in RAGS table formats ("Calculation of Chemical Cancer Risks and Non-Cancer Hazards"). Since the units of the RfD are mg/kg-day and the units of the CDI are mg/kg-day, the HQ and HI are dimensionless. HI ratios less than or equal to 1.0 indicate that adverse non-carcinogenic health effects are unlikely. Ratios greater than 1.0 indicate the potential for adverse non-carcinogenic health effects to occur at that exposure level and additional evaluation may be warranted. However, a ratio greater than 1.0 does not mean that adverse effects will definitely be observed, since the RfDs used in the calculation of these ratios incorporate uncertainty and modifying factors to reduce the potential that the likelihood of occurrence of adverse health effects will be underestimated. This procedure assumes that the risks from exposure to multiple chemicals are additive, an assumption that is probably valid for compounds that have the same target organ or cause the same toxic effect. HIs estimated to be in exceedance of 1.0 will be segregated and summed by target organ for further consideration.

Carcinogenic effects are expressed as excess lifetime cancer risks (ELCRs). Quantitative risk calculations for potentially carcinogenic COPCs estimate the potential ELCR for an individual in a specified population. This unit of risk refers to a potential cancer risk that is above the background cancer risk in unexposed individuals. For

example, an ELCR of 1 x 10^{-6} indicates that an exposed individual has an increased probability of one in one million of developing cancer as a result of the projected exposure, over the course of their lifetime. ELCRs will be estimated as the product of the CDI and the cancer slope factor (CSF). Since the units of the CDI and CSF are mg/kg-day and kg-day/mg, respectively, the resulting ELCR is dimensionless. For quantitative estimation of risk, it is assumed that cancer risks from various exposure routes are additive. Estimated ELCR values will also be presented in RAGS Part D table formats ("Calculation of Chemical Cancer Risks and Non-Cancer Hazards") and will be discussed relative to the 1 x 10^{-6} to 1 x 10^{-4} target risk range of ELCR values considered by the EPA to represent an acceptable (i.e., *de minimis*) risk.

The purposes of the Cancer Risks and Non-Cancer Hazards tables are summarized in the following items:

- To present the EPCs and CDIs used in the risk calculations;
- To present non-carcinogenic and carcinogenic risks calculated for each exposure route for each COPC; and
- To provide the total HIs and total ELCRs for all current and future exposure routes, environmental media of concern, and receptors.

All non-carcinogenic and carcinogenic risks calculated will be summarized in appropriate RAGS table formats ("Summary of Receptor Risks and Hazards for COPCs") for each receptor, by environmental medium, exposure route, and exposure point. RAGS Part D Table 10 ("Risk Summary") will summarize only those non-carcinogenic and carcinogenic risks for each receptor, by environmental medium, exposure route, and exposure point that exceed the 1 x 10^{-6} ELCR level or the 1.0 HI level. RAGS Part D Tables will be presented for the CT exposure scenario only when the RME exposure scenario indicates potentially unacceptable risk.

Identification of Limitations/Uncertainties

Uncertainties are encountered throughout the process of performing a risk assessment. This component will address the sources of uncertainty inherent in the main components of the BHRRA to be performed for the Site. Potential areas of uncertainties associated with each component of the BHHRA include: Sampling and Analysis, Selection of COPCs, Exposure Assessment, Toxicological Assessment, and Risk Characterization. The uncertainty analysis of the BHHRA will qualitatively discuss these items (and others that may be identified). No quantitative uncertainty analysis is assumed for the BHHRA.

Final Baseline Human Health Risk Assessment Report

Following a review of the comments provided by EPA Region 2 on the Draft BHHRA report, any clarifications required will be discussed with the EPA Region 2 Risk Assessment staff. Following resolution of these comments, a Final BHHRA incorporating final EPA comments on the Draft BHHRA will be submitted to EPA. The Final BHHRA will be submitted to EPA 14 days after the receipt of the final EPA comments.

3.7.2 Ecological Risk Assessment

Screening-Level Ecological Risk Assessment (SLERA)

Based on discussions with EPA, a screening-level ecological risk assessment (SLERA) will be performed as part of the RI/FS in accordance with EPA guidance (Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessment (EPA, 1997c; "ERAGS"). [*It is understood that based on*

the findings of the SLERA, a baseline ecological risk assessment (BERA) may be recommended. Note that the budget estimate does not include performance of the BERA at this time.]

For the SLERA, the following steps are planned:

- Ecological Resource Reconnaissance: The ecological resources reconnaissance effort will include compilation of existing information and a limited field effort (1-day field effort assumed for two persons). The following subtasks will be performed:

    - Desktop identification of the 100-year and 500-year floodplain adjacent to the Site;
    - Consultation with federal and state resource agencies to identify the presence of any endangered, threatened, or species of special concern;
    - A qualitative description of vegetation cover types present within the site boundaries based on field inspection; and a qualitative wildlife survey based upon direct and indirect observations of wildlife within the site area.

- Problem Formulation: tabulation and review of Site chemicals of potential concern (COPCs) in media of interest (soil, sediment, surface water); identification of potential ecological receptors (terrestrial / aquatic), exposure pathways, measurement and assessment endpoints and preparation of an ecological site conceptual model (SCM).

- Exposure Assessment: select geographical boundaries of the exposure areas to be evaluated for receptors; calculate exposure point concentrations (EPCs) for each COPC; select exposure parameters for surrogate receptors of interest (e.g., small and large trophic guilds) from the Wildlife Exposure Factors Handbook, recent EPA R2 ecological risk assessments, or other literature sources using simplified assumptions.

- Toxicity Assessment: complete a toxicity assessment for ecological receptors of interest for each COPC from the published literature and guidance.

- Risk Characterization: quantify risks to ecological receptors from each exposure pathway and COPC using Hazard Quotients (HQs).

- Evaluate Sources of Uncertainty: summarize where uncertain input parameters were employed in each step of the risk assessment and identify where the input values used may underestimate or overestimate true risks.

Screening Level Ecological Risk Assessment Report

A draft SLERA technical memorandum will be submitted 45 days following submission of the Data Evaluation Report Addendum for the Site. The SLERA will address Steps 1 and 2 of the ERAGS process. The memorandum will form the basis for documenting the initial evaluation of ecological risks for the Site. The SLERA will describe the environmental setting and preliminarily determine if ecological receptors are exposed to and potentially at risk as a result of exposure to contaminants in the environmental media associated with the Site. The SLERA will provide a preliminary estimate of risk for consideration as a project decision point, and provide the basis to determine the need for continuing the risk process through the performance of a BERA (i.e., ERAGS Steps 3 through 7).

The determination to continue ecological risk assessment work or finalize the screening level assessment will be made in consultation with EPA. If the determination is made to accept the screening level analysis without further need for the BERA, a response to EPA's comments on the draft SLERA will be prepared. Following EPA concurrence with the HDR responses, the SLERA will be finalized. If the decision is made to continue the risk assessment process, HDR will prepare a work plan amendment and scope for a BERA.

3.8 Task 9 – Remedial Investigation Report

3.8.1 Draft RI Report

HDR will review and collect environmental data required to complete the Peninsula Boulevard Groundwater Plume Site RI, identify potential sources of PCE that have impacted subsurface media at the site (if possible), and refine the SCM for subsurface contamination. Key contaminants (PCE and other VOCs) will be assessed on the basis of their persistence and mobility in the environment and by their degree of hazard to human and/or environmental receptors. These key contaminants will be evaluated for receptor exposure and an estimate of the contaminant levels reaching human or environmental receptors will be made. Existing standards and guidelines (e.g., drinking-water standards, water-quality criteria, and other criteria accepted by the EPA as appropriate for the situation) will be used for comparison with site data to evaluate potential effects to human receptors.

The RI Report will be written in accordance with "Guidance for Conducting Remedial Investigation/Feasibility Studies under CERCLA," OSWER Directive 9355.3-01, October 1988, Interim Final (or latest version) and "Guidance for Data Usability in Risk Assessment," (EPA/540/G-90/008), September 1990.

HDR will submit a Draft RI Report pursuant to the RI/FS schedule presented in this Work Plan. The Draft RI Report will include, but will not be limited to, the following major categories:

- Site Background;
- Investigation;
- Nature and Extent of Contamination;
- Fate and Transport.

Additional detail regarding the content and presentation for these RI report category is presented in the following sections. A Summary and Conclusions section will also be included at the end of the RI. [Risk Assessments and Laboratory Analysis are described in other parts of this Work Plan.]

Site Background

Summaries will be provided of available regional and site-specific information, including physical setting, demographic information, current and historical land uses, cultural resources, and current or historic environmental investigations. These summaries may include the following:

- An index map showing where the Site is located within the State of New York.
- A regional map(s) showing the location of the Site relative to nearby cultural or ecological features such as: residential, commercial and industrial areas; public water supply wells; schools; parks; wetlands; surface water bodies; other hazardous waste sites; etc. HDR will utilize available GIS resources (i.e., Nassau County government) to assist with mapping.
- A site map (or maps) showing the locations of other pertinent features to the RI (including, but not limited to: potential source locations, former Grove Cleaners site, utility corridors, major roadways for reference

points). Labels or a key will be used to explain the nature of each site feature. More than one map may be necessary to adequately represent operational changes over time.

- A topographic contour map presented at a sufficiently large scale (e.g., 1" = 50'; 1" = 100') and detail to allow sample locations to be plotted accurately in relation to site features. This may require that the site be divided into a number of maps to provide a sufficient level of detail. A smaller-scale index map will be provided to show the locations of the large scale maps relative to the entire site.
- Definitions of current and past hazardous materials practices at the Site. This will include a list of chemicals and hazardous materials produced, used, stored or disposed at the Site, as well as discussions of known methods of waste disposal.
- References to, and summaries of, all previous environmental studies and investigations involving the Site (e.g., NYSDEC, NCDH, EPA, other). These summaries will include discussions of the reasons for the investigation, as well as the key findings. Relevant data summaries, e.g., chemical analyses, contaminant plume maps, etc., will be provided either within the RI Report text or in appendices. The types of media that were analyzed, sampling dates, analytical parameters, and method detection limits for "non-detect" results will be provided, along with a summary of any significant sampling- or laboratory-related QA/QC problems.
- A map showing the location of all previous environmental sampling locations. In the event that locations are approximate (e.g., if they are determined from a written description or graphically transferred from an existing figure), this uncertainty will be noted.
- USGS has provided a compilation of records for public water supplies in the vicinity of the site using New York State Department of Environmental Conservation's Public Supply Well database and the USGS Groundwater Site Inventory (GWSI) and National Water Information System (NWIS) database. These records provide the coordinates, water bearing aquifer, drilled depth, and screened interval for public water supply wells in the vicinity of the Peninsula Boulevard site. These data will be incorporated into the RI report – in narrative, graphically, or both – so that the local hydrogeology can be better assessed.
- A discussion of the federal, state, and local regulatory history of the Site. This discussion will include references to pertinent correspondence, court orders, clean-up activities, and/or other relevant information relating to regulatory actions pertaining to the Site area. A table will be used to summarize the regulatory history activities and timelines.
- The findings, if available, of EPA's aerial photograph analysis provided in the Environmental Photographic Interpretation Center (EPIC). The EPIC findings may be summarized in the RI Report text and/or included as an appendix.
- Ecological concerns such as sensitive habitats, wetlands, floodplain information, or threatened or endangered species.

The RI will also obtain an updated summary of the vapor intrusion assessment work being conducted by EPA and present descriptions of existing sub-slab soil gas and indoor data, forecasted sampling and assessment work, and mitigation measures (such as installation of sub-slab depressurization systems) that have been implemented or planned.

Investigation

This portion of the RI report will address the following major investigative areas:

- Field Investigation and Technical Approach;
- Chemical Analysis and Analytical Methods;
- Field Methodologies;

- Soil Boring and Well Installation; and
- Environmental Sampling.

Soil Boring / Well Construction Logs: Graphical soil boring and monitoring well construction logs will be prepared to (a) describe the subsurface conditions encountered during intrusive operations, and (b) document well construction information (depth, screened interval, use of CMT technology or nested piezometers, etc.). Any drilling problems, unusual observations, detailed stratigraphic descriptions, or any other data of importance observed during soil boring and monitoring well installation work will be appropriately recorded (on logs, supplemental sheets [if needed], and in the field notes).

Monitoring well locations will be surveyed in the New York State Plane (Long Island Zone 3104) coordinate system, using the NAD 1983 horizontal datum and NAVD 88 vertical datum.

Conditions Warranting Immediate Removal Action: It is possible that during the course of the field investigation, conditions that warrant an immediate removal action to protect human health and/or the environment may be discovered. Examples of this type of situation include leaking drums, leaking underground or aboveground storage tanks, potentially explosive conditions, and evidence of contaminated drinking water wells. As much information as possible to detail the encountered condition will be provided in the report, so that the feasibility of conducting an immediate removal action can be evaluated.

Nature and Extent of Contamination

This section of the RI Report will be divided into two major subsections: contaminant sources, and contaminant distribution and trends.

Contaminant Sources - A full description of all potential contaminant source areas within the Site will be provided, utilizing all current and available pre-existing information. These discussions will include the following points: dimensions, depth below grade, depth to water table, waste volume, type of wastes/products, construction/demolition/closure dates, regulatory history, past/existing permits, historical changes in use or configuration, and available environmental sampling results.

Contaminant Distribution and Trends - A full discussion of the horizontal and vertical extent of contamination in groundwater and other media will be presented.

Discussions of the nature and extent of contamination will focus on those contaminants that pose the most significant risk to human health and the environment and exceed state or federal ARARs. Recent and historic sampling results will be quantitatively compared to sampling results from the RI investigation, only when the same or equivalent sample collection methods, analytical methods, QA/QC protocols, etc. were employed. If different methods, protocols, etc. were used, only qualitative comparisons will be made.

Physical and chemical properties of contaminants (e.g., density, solubility and mobility) exert significant effect on their distribution in the environment and their patterns of transport. Therefore, pertinent physical and chemical properties of site-related contaminants will be summarized in a table. Assumptions will not be made regarding the valence state of inorganic contaminants if only "total" analyses have been performed.

Site-specific background levels will be provided for soil using information that relates directly to the Site / Site area. This information will include the results of sampling and analyses conducted in the vicinity of the site. Background information presented in the previous project work by TtEC will be summarized and assessed.

Additional background data may potentially include location-specific data from sources such as the NYSDEC, USGS, USDA and New York Geological Survey. A table will be used to summarize the background levels for the Site.

Isoconcentration maps of site-related contaminants in groundwater (and other media) will be used to summarize the RI sampling results, and will illustrate the level and current extent of site-related contamination and may also illustrate potential future migration pathways. All applicable sampling information (i.e., all current RI data; all existing historic data will be considered) will be used in the development of the isoconcentration contour maps. Factors such as sampling and analytical protocols will be considered when comparing RI sampling results to sampling results from other sources.

Public water supply wells (i.e., LIAW Plant 5 Well Field, and other wells identified by HDR) will be indicated on the contaminant isoconcentration maps.

The number and types of isoconcentration plots, e.g., maps and/or cross sections, required will depend on the nature of the Site contamination. Development of isoconcentration plots will be considered for any site-related contaminant (e.g., PCE) or contaminant class (e.g., total VOCs) that exceeds ARARs and/or poses a relatively high risk to human health or the environment. For purposes of the budget estimate, the following isoconcentration plots are assumed:

- Groundwater (unconfined) - 1 plot each for PCE, chlorinated VOCs, petroleum-related VOCs, SVOCs, metals **[5]**
- Groundwater (semiconfined) - 1 plot each for PCE, chlorinated VOCs, petroleum-related VOCs, SVOCs, metals **[5]**
- Surface Soil - 1 plot each for PCE, chlorinated VOCs, petroleum-related VOCs, SVOCs, pesticides / PCBs, metals **[6]**
- Subsurface soil - 1 plot each for PCE, chlorinated VOCs, petroleum-related VOCs, SVOCs, pesticides / PCBs, metals **[6]**
- Sediment - 1 plot each for VOCs, SVOCs, pesticides / PCBs, metals **[4]**
- Surface Water -1 plot each for VOCs, SVOCs, pesticides / PCBs, metals **[4]**

Fate and Transport

This section of the RI Report will address three major issues.

- Contaminant Characteristics;
- Transport Processes; and
- Contaminant Migration Trends.

A qualitative assessment of the environmental fate and transport of site-related contaminants will be conducted on the basis of individual constituents, with the discussions grouped by contaminant class. In addition to consideration of the physical-chemical transport properties for individual constituents, this assessment will consider the potential for co-solvent effects on mobility. Site-specific properties of the environmental media will also be considered, including factors such as soil porosity, organic carbon fraction, and dry bulk density. No fate and transport, hydrogeological, or other computer modeling is included in the RI.

Summary and Conclusions

This section will focus upon integration of all available information to develop a comprehensive understanding, or "conceptual model," of the Site. As such, development of the conceptual model will require comparison of information derived from multiple sources, both current and historic, and from sampling and analysis of various environmental media, e.g., source materials, surface and subsurface soils, groundwater, etc. The intent will be to describe the current state of understanding of the link between the nature and magnitude (volume and mass) of source contamination, the applicable contaminant transport mechanisms, and the current nature and extent of site-related contamination. The summary will include an assessment of the limits of understanding, so that recommendations for additional sampling may be made to eliminate any critical data gaps. This model can then be used to predict future contaminant migration and to support decisions regarding remedial actions.

General Report Preparation Guidelines

The following guidelines will be used in preparing the Draft Remedial Investigation Report:

Figure Guidelines

- The original source of each figure will be referenced. If a pre-existing figure is modified, the new figure will reference both the pre-existing figure and its original source.
- The area of interest will be enlarged to fill as much of the available space on the page/plate as possible.
- All units, symbols, patterns, and scales used on figures will be fully explained in a key provided on the figure.
- All text and symbols used on maps, tables, and figures will be legible.
- Page numbers will be assigned to figures if necessary, so that they can be easily located or replaced in the text.

Map Format

- All maps will include an accurate north arrow, scale, a title explaining the purpose of the map, and an explanation of all symbols/notations. A reference will be provided to the source of the map if it is based on a pre-existing map.
- The scale will include both a written scale and a graphical scale. The inclusion of a graphical scale is essential because its accuracy will be retained even if the map is enlarged or reduced through reproduction processes.
- At least one base map with an appropriate map scale (e.g., 1 inch equals 50 feet, 1 inch equals 100 feet) will be utilized to accurately show the location of environmental sampling locations relative to known source areas, topographic contours, site boundary, and other important features.
- The surveyor's reference point/benchmark will be identified on the map.
- All units, symbols, and patterns used on the map will be fully described in an explanation included on the map. In addition, as applicable, the date that the data was collected will be indicated.
- The map title and figure/plate number will be shown in large bold type.
- Map figures will be created in AutoCAD [or Microstation]. AutoCAD /Microstation map data will be in a form that is geographically referenced to a standard coordinate system and is otherwise capable of being imported into and used in ArcGIS (formerly known as ArcView) without substantial additional manipulation.

Presentation of Analytical Results

- Tables of analytical results will be organized in a logical manner (e.g., by sample location number, sampling zone, etc.). For example, surface and subsurface soil analyses may be separated according to site location or specific contaminant source areas. Data tables obtained from previous investigation work will be imported into the RI report text, included in report attachments, or imported onto new RI tables created by HDR.
- The sample location identification number will always be used as the primary reference for the analytical results.
- Analytical tables will indicate the sample collection dates.
- The detection limit will be indicated in instances where a parameter was not detected.
- Analytical results will be reported in the text, tables, and figures using a consistent convention, such as ug/L for groundwater analyses, ug/kg for organic soil analyses, and mg/kg for inorganic soil analyses.
- The applicable federal/state criteria for each constituent will be specified on the analytical tables, and exceedances of criteria will be highlighted. Any samples where the detection limit is greater than the applicable criteria will be identified, and an explanation will be provided.

Discussion of Laboratory/Field Blank Contamination

- The lead agency's protocol for eliminating field sample analytical results based on laboratory/field blank contamination will be clearly explained.
- Discussion of approved sampling results will not be qualified by suggesting that a particular chemical is a common laboratory contaminant or was detected in a laboratory blank. If the reported result was validated utilizing the criteria presented in Section 3.5.3, it will be considered valid and usable.
- Results from field equipment rinsate blank analyses will be discussed, as necessary, if decontamination solvents are believed to have contaminated field samples.

3.8.2 Final RI Report

After EPA review of the Draft RI Report, HDR will incorporate final EPA comments and submit a Final RI Report (30 days after receipt of final EPA comments).

3.9 Task 10 - Identification and Screening of Remedial Alternatives

This task includes work efforts to develop appropriate remedial alternatives to undergo full evaluation. The alternatives will encompass a range including innovative treatment technologies consistent with the regulations outlined in the National Contingency Plan (NCP), 40 CFR Part 300, the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (OSWER Directive 9355.3-01) , as well as other applicable policies or guidance.

HDR will investigate only those hazardous waste management alternatives that will remediate or control contaminated media (groundwater, soils, surface water, and/or sediments) remaining at the Site, as deemed necessary in the RI and risk assessments, to provide adequate protection of human health and the environment. HDR will interface with EPA R2 with regards to the indoor air vapor intrusion pathway assessments being conducted at the Site, and discuss the utility of incorporating alternatives that address the vapor intrusion pathway (i.e., SSD systems) into the FS. It is currently assumed that the soil gas medium is not to be separately addressed in the FS.

The potential alternatives will encompass, as appropriate, 1) a range of alternatives in which treatment is used to reduce the toxicity, mobility and/or volume of wastes, but vary in the degree to which long-term management of

residuals or untreated waste is required, 2) one or more alternative involving containment with little or no treatment, and 3) a no-action alternative.

3.9.1 Draft Technical Memorandum

HDR will prepare a draft Technical Memorandum presenting the potential remedial alternatives, which includes the following:

Establish Remedial Action Objectives (RAOs). Based on existing information, HDR will identify site-specific RAOs which will be developed to protect human health and the environment. The objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route (i.e., preliminary remediation goals).

Establish General Response Actions (GRAs). HDR will develop GRAs for each medium of interest by defining containment, treatment, excavation / source removal, pumping, institutional controls, or other actions, singly or in combination to satisfy remedial action objectives. The response actions will take into account requirements for protectiveness as identified in the RAOs and the chemical and physical characteristics of the Site.

Identify & Screen Applicable Remedial Technologies. HDR will identify and screen technologies based on the developed GRAs. Hazardous waste treatment technologies will be identified and screened to ensure that only those technologies applicable to the contaminants present, their physical matrix, and other site characteristics will be considered. This screening will be based primarily on a technology's ability to effectively address the contaminants at the Site, but will also take into account a technology's implementability and cost. HDR will also identify potential sustainable / green concepts associated with the technologies (e.g., water conservation, energy requirements, land use /ecosystem impacts, material use, potential air emissions) as may be related to the Site. HDR will select representative process options, as appropriate, to carry forward into alternative development. The need for treatability testing for those technologies that are probable candidates for further consideration will also be identified.

Develop Remedial Alternatives. HDR will develop media-specific, or site-wide remedial alternatives, as appropriate, in accordance with the NCP. The developed alternatives will be defined with respect to conceptual information: size and configuration of the representative process options; time for remediation; rates of flow or treatment; spatial requirements; control of breakdown products / air emissions; distances for disposal; required permit approvals; imposed limitations; and other factors necessary to evaluate the alternatives.

For budget estimate purposes, it is assumed that the following number of remedial alternatives will be developed:

- Groundwater / unconfined: 8
- Groundwater / semi-confined (including NAPL): 10
- Soil: 8
- Sediment: 5 (may also include stormwater culverts / conveyance structures)
- Surface Water: 4

Categories of potential remedies may include:

- Groundwater: Extraction and ex-situ treatment; in-situ treatment; containment / slurry walls; thermal processes; monitored natural attenuation; and long-term monitoring.

- Soil: Source removal / excavation; capping / containment; in-situ treatment; and thermal processes. [Soil remedies are considered if the need to address potential contaminant sources is identified.]

- Sediment: Source removal / excavation; capping / containment; bioremediation / phytoremediation; flushing / cleaning (stormwater structures).

- Surface Water: biological treatment; natural attenuation; extraction and ex-situ treatment; and long-term monitoring.

During the FS work, HDR will update EPA on the final number of remedial alternatives being developed for each media. Note that the No Action alternative is included in the above numbers of alternatives assumed for each media.

Screen Remedial Alternatives for Effectiveness, Implementability, and Cost. If many distinct, viable alternatives are developed, HDR will screen the alternatives on a general basis with respect to their effectiveness, implementability and cost, to reduce the number of alternatives that will undergo detailed evaluation. Estimates of capital, O&M, and other costs associated with the alternatives will not be developed here; rather, the categories of costs and relative time frames typically associated with the alternatives will be discussed qualitatively.

Following the presentation of the remedial alternative screening process, HDR will present a qualitative discussion that provides the following information as related to green remediation opportunities for the Site:

- Identify potential sustainable elements that exist within the remedial alternatives being developed (e.g., monitored natural attenuation), or which can be incorporated into the alternatives (e.g., recycled or local materials; use of biodiesel or ultra low sulfur diesel as a fuel) ;
- Identify sustainable practices / operations that can be implemented during the life of the remedial alternative (i.e., items included on EPA R2 Green Site Assessment and Remediation Checklist such as, the use of green trailers / field office space, purchase of renewable energy, etc.).

3.9.2 Final Technical Memorandum

After the EPA's review of the Draft Technical Memorandum, HDR will incorporate EPA's comments and will submit the Final Technical Memorandum (14 days after receipt of final EPA comments).

3.10 Task 11 -Remedial Alternatives Evaluation

This task includes efforts associated with the assessment of individual alternatives against each of the nine current evaluation criteria and a comparative analysis of all options against the criteria. The analysis will be consistent with the NCP and will consider the Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA and other pertinent OSWER guidance. EPA will make the determination regarding the final selection of remedial alternatives.

The nine evaluation criteria applied to remedial alternatives in the FS are:

1. Overall protection of human health and the environment
2. Compliance with ARARs
3. Long-term effectiveness and permanence
4. Reduction in toxicity, mobility or volume through treatment
5. Short-term effectiveness

6. Implementability - technical and administrative
7. Cost
8. State acceptance
9. Community acceptance

For budget estimate purposes, it is assumed that the following number of remedial alternatives will be included for detailed evaluation:

- Groundwater / unconfined: 5
- Groundwater / semi-confined (including NAPL): 7
- Soil: 5
- Sediment: 3
- Surface Water: 2

During the FS work, HDR will update EPA on the final number of remedial alternatives being evaluated. The above numbers of remedial alternatives to be evaluated are estimates, and assume that all on-site media can be handled by a common technology (i.e., one "operable unit" assumed) installed in one or more locations at the Site. It is possible that "hybrid" remedies may be identified during or after the evaluation phase, and include components of more than one technology (e.g., source removal + AS/SVE; source removal + in-situ chemical oxidation; enhanced bioremediation + long-term monitoring).

Cost analyses will be created for each remedy based on the conceptual information developed. The costing is typically included on a 1-2 page line-item table, including end notes and assumptions utilized. Capital and OM&M costs will be presented as applicable to each remedy, as will the overall present value cost (assuming common interest rates) that is estimated. CERCLA FS contingencies (-30% - +50%) will also be incorporated into the cost analyses.

3.10.1 Draft Technical Memorandum

HDR will prepare a Draft Technical Memorandum which addresses the following: 1) a technical description of each alternative that outlines waste management strategy involved and identifies the key ARARs associated with each alternative, and 2) a discussion that profiles the performance of each alternative with respect to the first seven evaluation criteria listed above. Once the individual analysis is complete, the alternatives will be compared and contrasted to one another with respect to the first seven evaluation criteria listed above. The evaluation of alternatives with respect to the last two criteria - State Acceptance and Community Acceptance - will be performed later in the Feasibility Study process (i.e., these evaluations are typically performed during preparation of the Proposed Plan and ROD).

Following the above-described remedial alternatives evaluation, HDR will present a qualitative assessment on how green remediation (or elements of sustainability that can be incorporated into a conventional remedy) can be connected to the FS. This narrative is not meant to modify the FS threshold and balancing criteria or overall evaluation process. Rather, it looks to expand on the discussions presented in the alternatives screening phase and further evaluate potential sustainable elements that may exist within the final remedial alternatives, or which can be incorporated into them. For example, remedies may be combined to address more than one media simultaneously (i.e., air sparging / soil vapor extraction). EPA resources (such as clu-in.org) will be utilized for this qualitative assessment. No quantitative analyses (such as life cycle costs) are proposed.

3.10.2 Final Technical Memorandum

After the EPA's review of the Draft Technical Memorandum, HDR will incorporate EPA's comments and will submit the Final Technical Memorandum (14 days after receipt of final EPA comments).

3.11 Task 12 – Feasibility Study (FS) Report

HDR will develop a FS Report consisting of a detailed analysis of alternatives and a cost-effectiveness analysis in accordance with 40 CFR 300.430. The report will also include a review of the nine criteria for evaluation.

3.11.1 Draft FS Report

HDR will prepare a Draft FS that will contain the following:

- Summary of feasibility study objectives
- Summary of remedial action objectives (RAOs)
- Identification of general response actions (GRAs)
- Identification and screening of remedial action technologies, including innovative technologies
- Description of remedial alternatives
- Screening of remedial alternatives
- Detailed analysis of remedial alternatives
- Perspectives on green remediation opportunities
- Overall summary and conclusions

HDR's technical feasibility considerations will include the careful study of any problems that may prevent a remedial alternative from mitigating site problems. Therefore, the characteristics from the RI will be kept in mind as technical feasibility of an alternative is studied. Specific items that will be addressed will include the reliability (operation over time), safety, operations and maintenance, ease with which the alternative can be implemented, and time needed for implementation.

HDR will include a floodplain assessment as part of the Feasibility Study report if remedial alternatives will be necessary within the 100-year or 500-year floodplain. The floodplain assessment will reference the RI's delineation of the floodplains in the project area, and include a description of the effects of potential remedial actions on both floodplains (including a brief description of the alternatives to the proposed action and their effects on the floodplains), and a description of measures that are proposed or necessary to minimize potential adverse impacts on both floodplains.

3.11.2 Final FS Report

After the EPA's review of the Draft FS Report, HDR will incorporate EPA's comments and will submit the Final FS Report (30 days after receipt of final EPA comments).

3.12 Task 13 - Feasibility Study Addendum

HDR will provide technical support for the preparation of the ROD for the Site. HDR's support may include: attendance at technical meetings and assistance on review of the Responsiveness Summary, Proposed Remedial Action Plan (PRAP) and ROD. No deliverable is assumed under this Task.

3.13 Task 16 - Work Assignment Closeout

Upon notification from EPA that all technical work performed under this Work Assignment is complete; project closeout activities will be performed. These activities will include: closing out subcontracts, preparation of a technical and financial Work Assignment Closeout Report (WACR), indexing and consolidating project records and files, microfilming documents and returning the technical project files and microfilm to EPA. HDR will maintain technical and financial records associated with the RI/FS in accordance with contract requirements. Further details of these activities are provided in the subsections that follow.

3.13.1 Work Assignment Closeout Report (WACR)

Final costs and LOE for all activities conducted by HDR under this Work Assignment will be included in a WACR and provided as an electronic copy. Costs and LOE (by P-level) will be categorized in the same detail and format as the elements contained in the Work Plan and the SOW. The WACR will be submitted to EPA after the files and microfilm are ready to be sent to EPA.

3.13.2 Document Indexing

HDR will organize the Work Assignment technical files in accordance with the approved EPA file index structure. A file review will be performed to ensure that all file elements are present and are in order, and that any duplicate or draft technical report copies are removed from the project file.

3.13.3 Document Retention/Conversion

Following document indexing the project technical files will be microfilmed. The microfilm and hard copies of the project technical files will be sent to EPA. HDR will retain a copy of the microfilm of the files (i.e. hard copies of the technical files will not be retained by HDR.

4 Project Management Approach

4.1 Project Organization

HDR will provide project administration and management support to complete the work assignment. Figure 4 depicts HDR's project organization for the Peninsula Blvd RI/FS Work Assignment. For HDR the overall Program Manager will be Bradley C. Williams, Ph.D. The Project Manager is Michael Musso, P.E. The Project Manager has the primary responsibility for developing the RI/FS work plan and other technical memorandum, managing day to day activities, communicating with the EPA WAM, directing and implementing field activities, identifies staff requirements and is responsible for performance within the established budget and schedule.
Technical support personnel for this project include community relations, geology/hydrology, field investigation/data acquisition, human health and ecological risk assessment, remedial engineering, health and safety, and quality assurance. The technical leads will perform or supervise activities related to their area of expertise and provide input and support to the Project Manager as needed.

4.2 Project Schedule

HDR's schedule is dependent on the approval of this work plan. For the purposes of preparing this work plan, HDR based the duration of the assignment on the work assignment, which outlines the major project submittals and their required due dates. The major project submittals and the corresponding due date requirements are summarized in the attached table.

The HDR project team is committed to completing the work assignment on-time and will work diligently with the entire project team to achieve this end.

5 References

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USEPA, Technology Innovation Program, http://www.clu-in.org/greenremediation/subtab_b1.cfm

TABLE 1 - DELIVERABLES

WORK PLAN
EPA REGION 2 AES CONTRACT NO. EP-W-09-009
SCHEDULE / DELIVERABLES

WORK ASSIGNMENT NO: 002-RICO-02TV **WORK ASSIGNMENT TITLE: PENINSULA BLVD - RI/FS**
WORK PLAN NO: 0 **WORK ASSIGNMENT TYPE: RI/FS**

Statement of Work Task No.		Task Name	Due Date	# Copies *
Task 1		**Project Planning and Support**		
1	1.4	Draft RI/FS Work Plan	45 Days After Scoping Meeting	3
1	1.7	Draft Quality Assurance Project Plan	21 Days After Receipt of Final Comments on draft RI/FS Work Plan	3
1	1.7	Final Quality Assurance Project Plan	15 Days after receipt of Final Comments	3
1	1.8	Draft Health and Safety Plan	21 Days After Receipt of Final Comments on draft RI/FS Work Plan	3
1	1.8	Final Health and Safety Plan	15 Days After Receipt of Final Comments	3
1	1.13	Pathways Analysis Report	21 Days After Submission of Data Evaluation Report, under Task 6.4	3
Task 2		**Community Relations**		
2	2.2	Draft Community Relations Plan (CRP)	60 Days After Completion of Community Interviews, under Task 2.1	2
2	2.2	Final CRP	14 Days After Final Comments on Draft CRP	2
2	2.4	Fact Sheets	7 Days Prior to Public Meeting/Event	3
2	2.6	Public Notices	14 Days Prior to Public Meeting/Event	3
2	2.8	Site Mailing List	14 Days After Approval of Final CRP	2
Task 5		**Analytical Support & Data Validation**		
5	5.3	Data Validation	30 Days After Receipt of All Analytical Data from Laboratory	1
Task 6		**Data Evaluation of Samples**		
6	6.4	Data Evaluation Report	30 Days After Completion of Subtask 6.2	5
Task 7		**Risk Assessment**		
7	7.1	Draft Baseline Human Health Risk Assessment Report	45 Days After Approval of Pahtways Analysis Report, under Task 1.13	3
7	7.1	Final Baseline Human Health Risk Assessment Report	14 Days After Receipt of EPA Final Comments	3

TABLE 1 - DELIVERABLES

WORK PLAN
EPA REGION 2 AES CONTRACT NO. EP-W-09-009
SCHEDULE / DELIVERABLES

WORK ASSIGNMENT NO: 002-RICO-02TV **WORK ASSIGNMENT TITLE: PENINSULA BLVD - RI/FS**
WORK PLAN NO: 0 **WORK ASSIGNMENT TYPE: RI/FS**

Statement of Work Task No.		Task Name	Due Date	# Copies *
7	7.2	Ecological Risk Assessment	Within 45 Days After Submission of the DER, under Task 6.4	3
Task 9		**Remedial Investigation (RI) Report**		
9	9.1	Draft RI Report	90 Days After Submittal of Data Evluation Report, under Task 6.4	6
9	9.2	Final RI Report	30 Days After Receipt of EPA Final Comments	6
Task 10		**Remedial Alternatives Screening**		
10	10.1	Draft Technical Memorandum	60 Days After Submission of Final RI Report	3
10	10.2	Final Technical Memorandum	14 Days After Receipt of Comments on Draft Report	3
Task 11		**Remedial Alternatives Evaluation**		
11	11.1	Draft Technical Memorandum	30 Days After Task 10.2 Report	3
11	11.2	Final Technical Memorandum	14 Days After Receipt of EPA Final Comments on Draft Report	3
Task 12		**Feasibility Study (FS) Report**		
12	12.1	Draft FS Report	45 Days After Approval of Task 11.2 Report	6
12	12.2	Final RI Report	30 Days After Receipt of EPA Final Comments	6
Task 16		**Work Assignment Closeout**		
16	16.1	Work Assignment Completion Report	30 Days After Work Assignment Closeout Notification from EPA	3

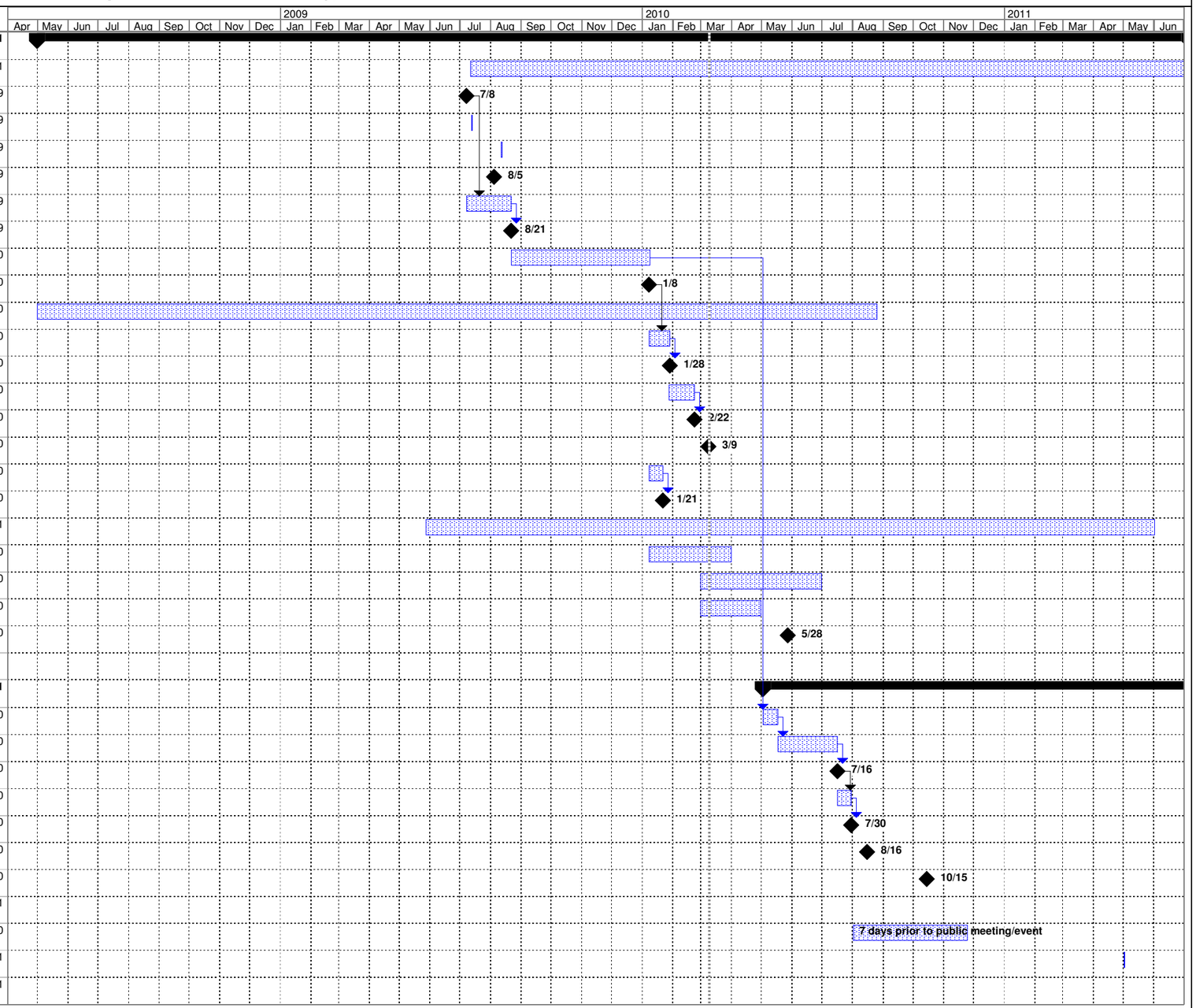
* Electronic copies of all deliverables will be provided.

Rationale for Proposed Well Installation Locations
Peninsula Boulevard Groundwater Plume

Proposed Well ID	Shallow Interval Screen Depth (ft)	Deep Interval Screen Depth (ft)	Rationale for Location / Depth Intervals	Intersection / Proposed Well Location
MW-24	20	60	Downgradient from deeper plume. There is a data gap for deeper groundwater. This proposed well is in the vicinity of Mill Rd Drive-In (dry cleaner).	Mill Rd. & Waverly St. (Waverly Street, between Mill Road & Hewlett Parkway)
MW-25	25	60	Farther-field downgradient well. This proposed well is west of the furthest east deep detection at HW-222.	Chestnut Dr. & Oak Dr. (Chestnut Drive, SE bend)
MW-26	25	70	This proposed well is located immediately downgradient from the highest concentrations detected in deep groundwater. There is a data gap for deep groundwater in this area east of Mill Rd.	Mill Rd. (N end of municipal lot) (Oak Drive near Mill Road)
MW-27	30	70	This proposed well will provide a deep groundwater evaluation at the former Choe's Dry Cleaners (currently Cedarwood Cleaners). There is a data gap for deep groundwater in this area. Also provides a point very near the updgradient edge of the overall plume (along the main axis of the plume).	W. Broadway & Hewlett Pkwy. (Hewlett Parkway near W. Broadway)
MW-28	30	70	Near south boundary of site. The proposed well will be upgradient from former Choe's Dry Cleaners (currently Cedarwood Cleaners) and along the estimated edge of the shallow plume. There is a data gap for deep groundwater and this point provides an upgradient point for the deep groundwater, as well as an upgradient point along the main axis of the overall plume.	W. Broadway & Hamilton Ave. (New Street near Hewlett Plaza)
MW-29	20	75	General upgradient well for deeper groundwater detections. This proposed well will be along the estimated western edge of the shallow plume.	Hamilton Ave. & Center St. (Centre Street near Hamilton Avenue)
Alternate			This would be more centrally located amongst the southeast group of dry cleaners, but is side-gradient to any hotspots. This is a very congested area.	near Broadway & Piermont Ave.

DRAFT Figure 1
USEPA Contract EP-W-09-009
Work Assignment # 002-RICO-02TV
Peninsula Blvd Superfund Site
Village of Hewlett, Nassau County, New York

ID	Task Name	Duration	Start	Finish
1	**Task 1: Project Planning and Support**	**1040 days**	**Thu 5/1/08**	**Wed 7/6/11**
2	1.1 Project Administration / Management	725 days	Sun 7/12/09	Wed 7/6/11
3	1.2 Attend Scoping Meeting	0 days	Wed 7/8/09	Wed 7/8/09
4	1.3 Conduct Site Visit (initial)	1 day	Mon 7/13/09	Mon 7/13/09
5	1.3 Conduct Site Visit (secondary)	1 day	Wed 8/12/09	Wed 8/12/09
6	1.4 Develop Draft Work Plan and Associated Cost Estimate (meeting)	0 days	Wed 8/5/09	Wed 8/5/09
7	1.4 Develop Draft Work Plan and Associated Cost Estimate	45 days	Wed 7/8/09	Fri 8/21/09
8	1.4 Submit Draft Work Plan and Associated Cost Estimate	0 days	Fri 8/21/09	Fri 8/21/09
9	1.5 Negotiate and Revise Draft Work Plan/Budget	140 days	Sat 8/22/09	Fri 1/8/10
10	1.5 Draft Work Plan Approval	0 days	Fri 1/8/10	Fri 1/8/10
11	1.6 Evaluate Existing Data and Documents	725 days	Thu 5/1/08	Wed 8/25/10
12	1.7 Quality Assurance Project Plan (Draft)	21 days	Fri 1/8/10	Thu 1/28/10
13	1.7 Submit Quality Assurance Project Plan (Draft)	0 days	Thu 1/28/10	Thu 1/28/10
14	1.7 Quality Assurance Project Plan (Final)	26 days	Thu 1/28/10	Mon 2/22/10
15	1.7 Submit Quality Assurance Project Plan (Final)	0 days	Mon 2/22/10	Mon 2/22/10
16	1.7 EPA Approval of Quality Assurance Project Plan (Final)	0 days	Tue 3/9/10	Tue 3/9/10
17	1.8 Health & Safety Plan	14 days	Fri 1/8/10	Thu 1/21/10
18	1.8 Submit Health & Safety Plan	0 days	Thu 1/21/10	Thu 1/21/10
19	1.10 Meetings (8 meeting throughout the project)	725 days	Thu 5/28/09	Wed 6/1/11
20	1.11 Subcontract Procurement	83 days	Fri 1/8/10	Wed 3/31/10
21	1.12 Perform Subcontract Management (duration of Task 3)	122 days	Mon 3/1/10	Wed 6/30/10
22	1.13 Pathways Analysis Report	61 days	Mon 3/1/10	Fri 4/30/10
23	1.13 Submit Pathways Analysis Report (Interim DRAFT)	0 days	Fri 5/28/10	Fri 5/28/10
24				
25	**Task 2: Existing Data Review & Field Reconnaissance**	**577 days**	**Mon 5/3/10**	**Thu 12/1/11**
26	2.1 Community Interviews	15 days	Mon 5/3/10	Mon 5/17/10
27	2.2 Community Relations Plan (Draft)	60 days	Tue 5/18/10	Fri 7/16/10
28	2.2 Submit Community Relations Plan (Draft)	0 days	Fri 7/16/10	Fri 7/16/10
29	2.2 Community Relations Plan (Final)	14 days	Sat 7/17/10	Fri 7/30/10
30	2.2 Submit Community Relations Plan (Final)	0 days	Fri 7/30/10	Fri 7/30/10
31	2.3 Public Meeting Support	0 days	Mon 8/16/10	Mon 8/16/10
32	2.3 Public Meeting Support	0 days	Fri 10/15/10	Fri 10/15/10
33	2.3 Public Meeting Support	0 days	Thu 12/1/11	Thu 12/1/11
34	2.4 Fact Sheet Preparation	115 days	Mon 8/2/10	Wed 11/24/10
35	2.5 Proposed Plan Support	1 day	Mon 5/2/11	Mon 5/2/11
36	2.6 Public Notices	14 days	Mon 8/1/11	Sun 8/14/11

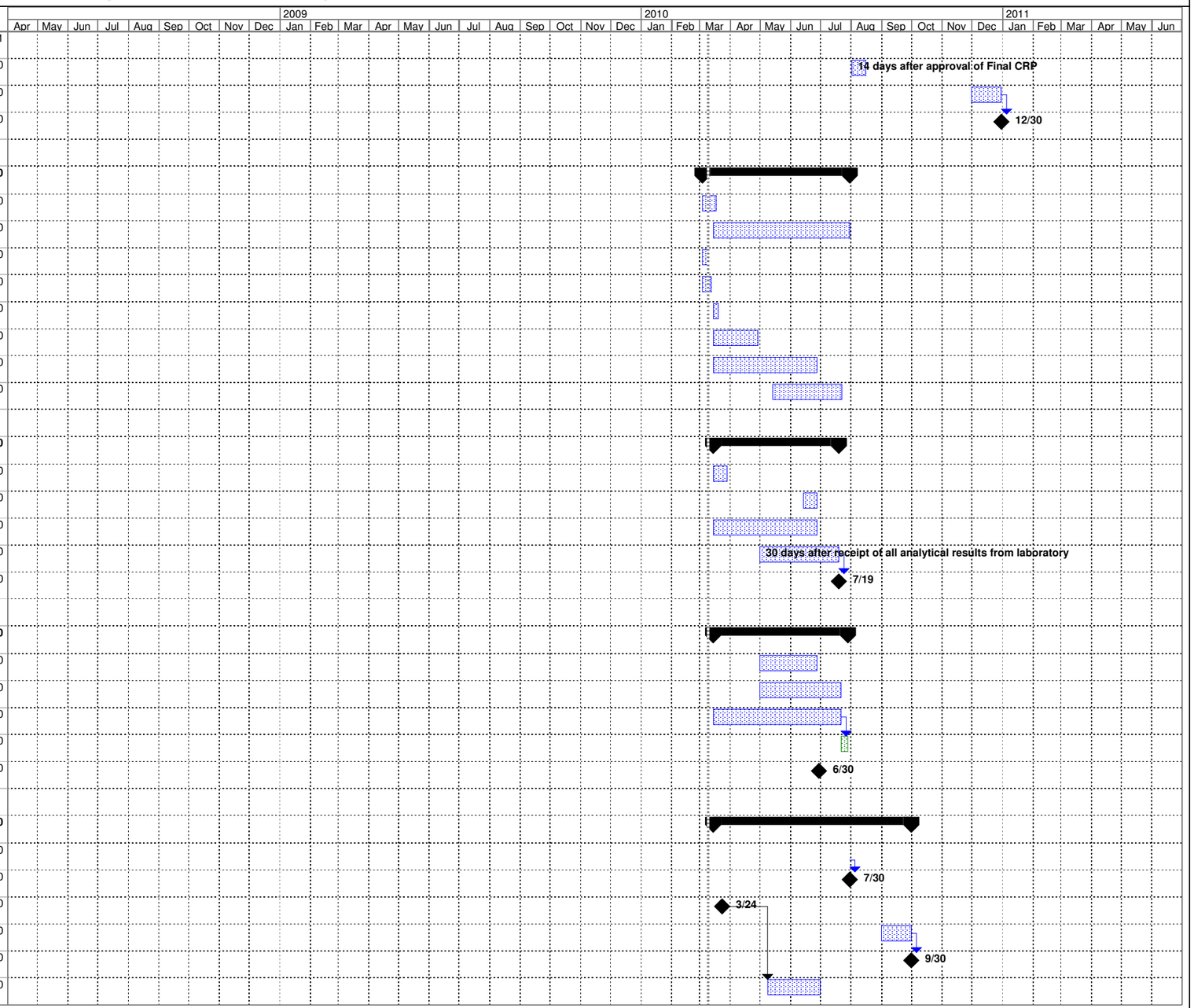


Peninsula Blvd - RI/FS
Date: Tue 3/9/10

Task | Progress | Summary | External Tasks | Deadline
Split | Meeting/Deliverable | Project Summary | External Milestone

DRAFT Figure 1
USEPA Contract EP-W-09-009
Work Assignment # 002-RICO-02TV
Peninsula Blvd Superfund Site
Village of Hewlett, Nassau County, New York

ID	Task Name	Duration	Start	Finish
37	2.7 Information Repositories	1 day	Mon 8/1/11	Mon 8/1/11
38	2.8 Site Mailing List	14 days	Mon 8/2/10	Sun 8/15/10
39	2.9 Responsiveness Summary	30 days	Wed 12/1/10	Thu 12/30/10
40	2.9 Submit Responsiveness Summary	0 days	Thu 12/30/10	Thu 12/30/10
41				
42	**Task 3: Field Investigation**	**149 days**	**Thu 3/4/10**	**Fri 7/30/10**
43	3.2 Mobilization and Demobilization	14 days	Thu 3/4/10	Wed 3/17/10
44	3.3 Hydrogeologic Assessment	138 days	Mon 3/15/10	Fri 7/30/10
45	3.4 Soil Borings, Drilling, and Testing - One-call / mark-outs	5 days	Thu 3/4/10	Mon 3/8/10
46	3.4 Soil Borings, Drilling, and Testing - obtain permits	9 days	Thu 3/4/10	Fri 3/12/10
47	3.4 Soil Borings, Drilling, and Testing - set up IDW / decon area	5 days	Mon 3/15/10	Fri 3/19/10
48	3.4 Soil Borings, Drilling, and Testing	45 days	Mon 3/15/10	Wed 4/28/10
49	3.5 Environmental Sampling	105 days	Mon 3/15/10	Sun 6/27/10
50	3.8 Investigation Derived Waste Characterization & Disposal	70 days	Fri 5/14/10	Thu 7/22/10
51				
52	**Task 5: Analytical Support and Data Validation**	**127 days**	**Mon 3/15/10**	**Mon 7/19/10**
53	5.1 Collect, Prepare and Ship Samples - round 1	14 days	Mon 3/15/10	Sun 3/28/10
54	5.1 Collect, Prepare and Ship Samples - round 2	14 days	Mon 6/14/10	Sun 6/27/10
55	5.2 Sample Management	105 days	Mon 3/15/10	Sun 6/27/10
56	5.3 Data Validation	80 days	Sat 5/1/10	Mon 7/19/10
57	5.3 Submit Data Validation (Report)	0 days	Mon 7/19/10	Mon 7/19/10
58				
59	**Task 6: Data Evaluation**	**136 days**	**Mon 3/15/10**	**Wed 7/28/10**
60	6.1 Data Usability Evaluation	58 days	Sat 5/1/10	Sun 6/27/10
61	6.2 Data Reduction, Tabulation, and Evaluation	82 days	Sat 5/1/10	Wed 7/21/10
62	6.4 Data Evaluation Report (addendum)	129 days	Mon 3/15/10	Wed 7/21/10
63	6.4 Submit Data Evaluation Report (addendum)	7 days	Thu 7/22/10	Wed 7/28/10
64	6.4 Data Evaluation Report (addendum) (meeting)	0 days	Wed 6/30/10	Wed 6/30/10
65				
66	**Task 7: Risk Assessment**	**200 days**	**Mon 3/15/10**	**Thu 9/30/10**
67	7.1 Baseline Human Health Risk Assessment (Draft)	138 days	Mon 3/15/10	Fri 7/30/10
68	7.1 Submit Baseline Human Health Risk Assessment (Draft)	0 days	Fri 7/30/10	Fri 7/30/10
69	7.1 Baseline Human Health Risk Assessment (scoping meeting)	0 days	Wed 3/24/10	Wed 3/24/10
70	7.1 Baseline Human Health Risk Assessment (Final)	30 days	Wed 9/1/10	Thu 9/30/10
71	7.1 Submit Baseline Human Health Risk Assessment (Final)	0 days	Thu 9/30/10	Thu 9/30/10
72	7.2 Ecological Risk Assessment (Draft)	53 days	Sun 5/9/10	Wed 6/30/10

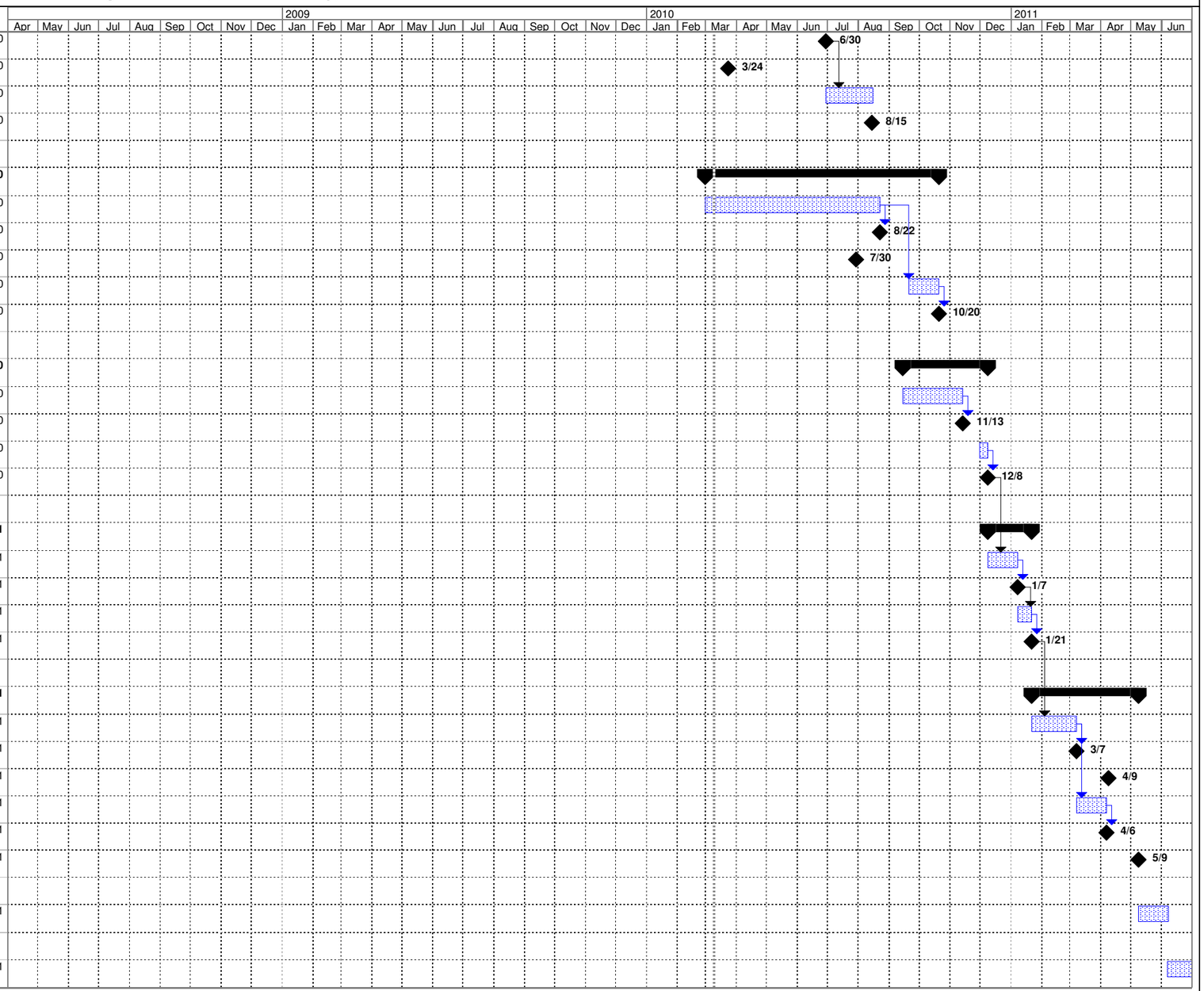


Peninsula Blvd - RI/FS
Date: Tue 3/9/10

Task | Progress | Summary | External Tasks | Deadline
Split | Meeting/Deliverable | Project Summary | External Milestone

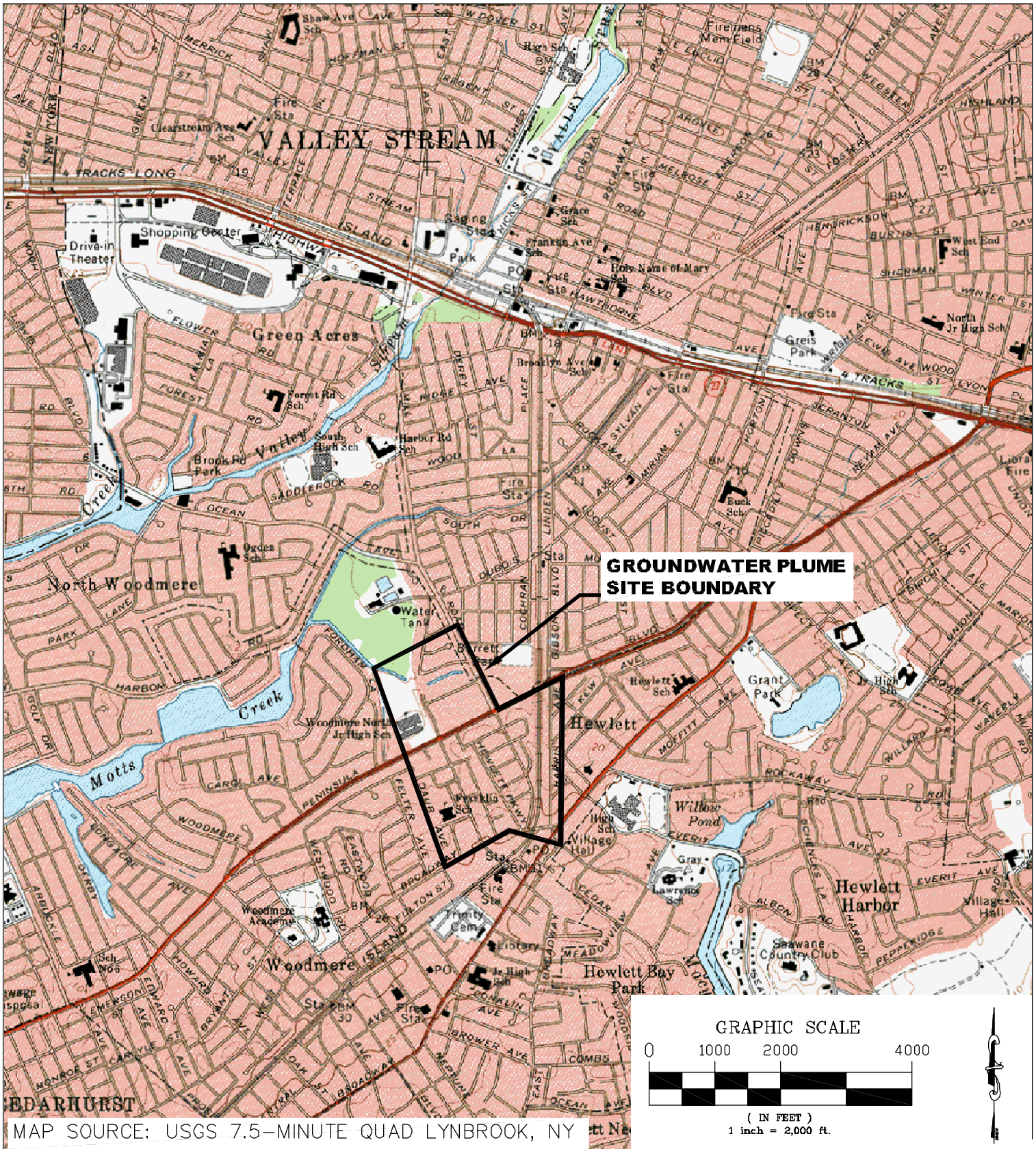
DRAFT Figure 1
USEPA Contract EP-W-09-009
Work Assignment # 002-RICO-02TV
Peninsula Blvd Superfund Site
Village of Hewlett, Nassau County, New York

ID	Task Name	Duration	Start	Finish
73	7.2 Submit Ecological Risk Assessment (Draft)	0 days	Wed 6/30/10	Wed 6/30/10
74	7.2 Ecological Risk Assessment (scoping meeting)	0 days	Wed 3/24/10	Wed 3/24/10
75	7.2 Ecological Risk Assessment (Final)	47 days	Wed 6/30/10	Sun 8/15/10
76	7.1 Submit Ecological Risk Assessment (Final)	0 days	Sun 8/15/10	Sun 8/15/10
77				
78	**Task 9: Remedial Investigation Report**	**234 days**	**Mon 3/1/10**	**Wed 10/20/10**
79	9.1 Draft Remedial Investigation Report	175 days	Mon 3/1/10	Sun 8/22/10
80	9.1 Submit Draft Remedial Investigation Report	0 days	Sun 8/22/10	Sun 8/22/10
81	9.1 Draft Remedial Investigation Report (meeting)	0 days	Fri 7/30/10	Fri 7/30/10
82	9.2 Final Remedial Investigation Report	30 days	Tue 9/21/10	Wed 10/20/10
83	9.2 Submit Final Remedial Investigation Report	0 days	Wed 10/20/10	Wed 10/20/10
84				
85	**Task 10: Remedial Alternatives Screening**	**85 days**	**Wed 9/15/10**	**Wed 12/8/10**
86	10.1 Draft Technical Memorandum	60 days	Wed 9/15/10	Sat 11/13/10
87	10.1 Submit Draft Technical Memorandum	0 days	Sat 11/13/10	Sat 11/13/10
88	10.2 Final Technical Memorandum	8 days	Wed 12/1/10	Wed 12/8/10
89	10.2 Submit Final Technical Memorandum	0 days	Wed 12/8/10	Wed 12/8/10
90				
91	**Task 11: Remedial Alternatives Evaluation**	**44 days**	**Thu 12/9/10**	**Fri 1/21/11**
92	11.1 Draft Technical Memorandum	30 days	Thu 12/9/10	Fri 1/7/11
93	11.1 Submit Draft Technical Memorandum	0 days	Fri 1/7/11	Fri 1/7/11
94	11.2 Final Technical Memorandum	14 days	Sat 1/8/11	Fri 1/21/11
95	11.2 Submit Final Technical Memorandum	0 days	Fri 1/21/11	Fri 1/21/11
96				
97	**Task 12: Feasibility Study**	**107 days**	**Sat 1/22/11**	**Mon 5/9/11**
98	12.1 Draft FS Report	45 days	Sat 1/22/11	Mon 3/7/11
99	12.1 Submit Draft FS Report	0 days	Mon 3/7/11	Mon 3/7/11
100	12.1 Draft FS Report (scoping meeting)	0 days	Sat 4/9/11	Sat 4/9/11
101	12.2 Final FS Report	30 days	Tue 3/8/11	Wed 4/6/11
102	12.2 Submit Final FS Report	0 days	Wed 4/6/11	Wed 4/6/11
103	12.2 Final FS Report (meeting)	0 days	Mon 5/9/11	Mon 5/9/11
104				
105	**Task 13: FS Addendum**	30 days	Mon 5/9/11	Tue 6/7/11
106				
107	**Task 16: Work Assignment Close-out**	30 days	Tue 6/7/11	Wed 7/6/11



Peninsula Blvd - RI/FS
Date: Tue 3/9/10

Task | Progress | Summary | External Tasks | Deadline
Split | Meeting/Deliverable | Project Summary | External Milestone



MAP SOURCE: USGS 7.5–MINUTE QUAD LYNBROOK, NY

HDR

SITE LOCATION MAP

PENINSULA BOULEVARD GROUNDWATER PLUME

DATE
08–17–09

FIGURE
2

LONG ISLAND AMERICAN WATER PLANT #2

MOTTS CREEK

GROUNDWATER PLUME SITE BOUNDARY

DOXEY BROOK DRAIN

MOTTS CREEK

WOODMERE MIDDLE SCHOOL

UNNAMED TRIBUTARY

FORMER GROVE CLEANERS

NORTH

GRAPHIC SCALE

400 200 0 200 400 800 1200

(IN FEET)

1 inch = 400 ft.

HDR

SURFACE WATER MAP

PENINSULA BOULEVARD GROUNDWATER PLUME SITE

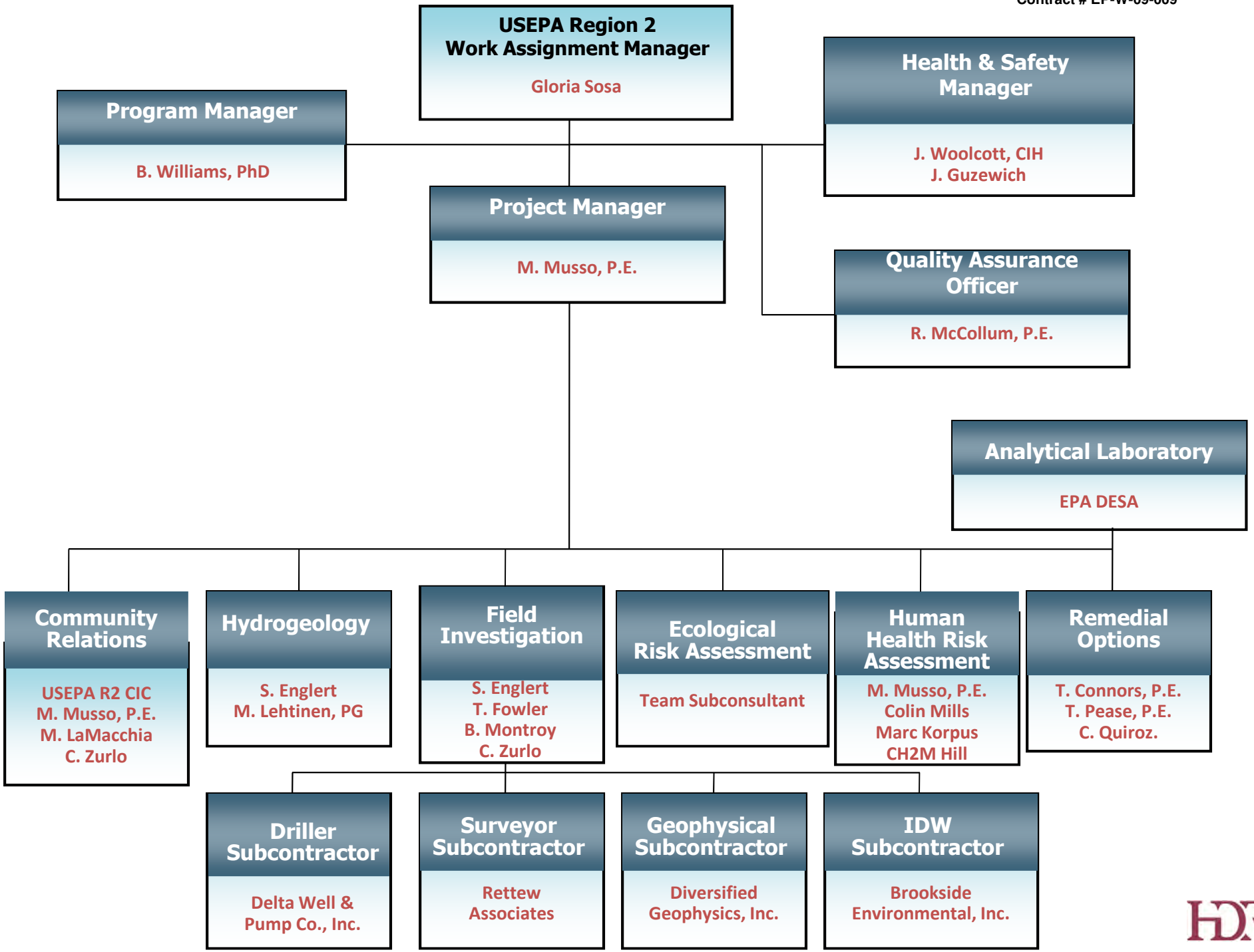
DATE

08-18-09

FIGURE

3

Figure 4 - Project Organization Structure



LEGEND

- MONITORING WELL INSTALLED IN 2007
- PIEZOMETER INSTALLED IN 2007
- EXISTING MONITORING WELL
- EXISTING PIEZOMETER
- SITE BOUNDARY
- GROUND ELEVATION CONTOUR
- (Shallow ~15-20 FT) (Deep ~60 FT) PROPOSED MONITORING WELL LOCATION AND DEPTH
- (Shallow ~15-20 FT) (Deep ~60 FT) PROPOSED CONTINUOUS MULTI-CHANNEL TUBING MONITORING WELL
- APPROX EXTENT OF PCE> 5 ug/L IN SHALLOW GROUNDWATER
- APPROX EXTENT OF PCE> 5 ug/L IN DEEP GROUNDWATER
- GROUNDWATER FLOW DIRECTION – SHALLOW
- GROUNDWATER FLOW DIRECTION – DEEP
- ACTIVE OR FORMER DRY CLEANER LOCATION
- SB SOIL BORING

EVERIT CLEANERS

AMERICAN DRIVE-IN

VELVET TOUCH CLEANERS (FORMER)

PIERMONT CLEANERS

MILL ROAD DRIVE-IN

FORMER GROVE CLEANERS

VOGUE FRENCH CLEANERS

CHOE'S WEST BROADWAY CLEANERS

(Shallow ~20-25 FT) (Deep ~60 FT) SB/CMT-25

(Shallow ~20-25 FT) (Deep ~70 FT) SB/CMT-26

(Shallow ~15-20 FT) (Deep ~60 FT) SB/MW-24

(Shallow ~32 FT) (Deep ~70 FT) SB/CMT-27

(Shallow ~32 FT) (Deep ~70 FT) SB/CMT-28 (NEW ST. NEAR HEWLETTE PLAZA)

(Shallow ~15-20 FT) (Deep ~75-80 FT) SB/MW-29

PZ-01 PZ-02 PZ-03 PZ-04 PZ-05 PZ-06 PZ-07 PZ-08 PZ-09 PZ-10

MW-03D MW-03S MW-04 MW-06 MW-07 MW-08 MW-10D MW-10S MW-11 MW-12 MW-13D MW-13S MW-14 MW-16 MW-17 MW-18D MW-18S MW-19 MW-20 MW-21D MW-21S MW-22D MW-22S MW-23

GP-09 GP-10 GP-30 GP-35 GP-39 GP-49 N1114

NOTE: EXISTING PLUME DELINEATION AND WELL/PIEZOMETER LOCATIONS SHOWN ABOVE ARE BASED ON THE DATA EVALUATION REPORT FIGURES 3-3, 6-3, & 6-4 PREPARED BY TETRA TECH EC, INC. FOR THE USEPA

GRAPHIC SCALE

0 150 300 600

(IN FEET)

1 inch = 300 ft.

HDR

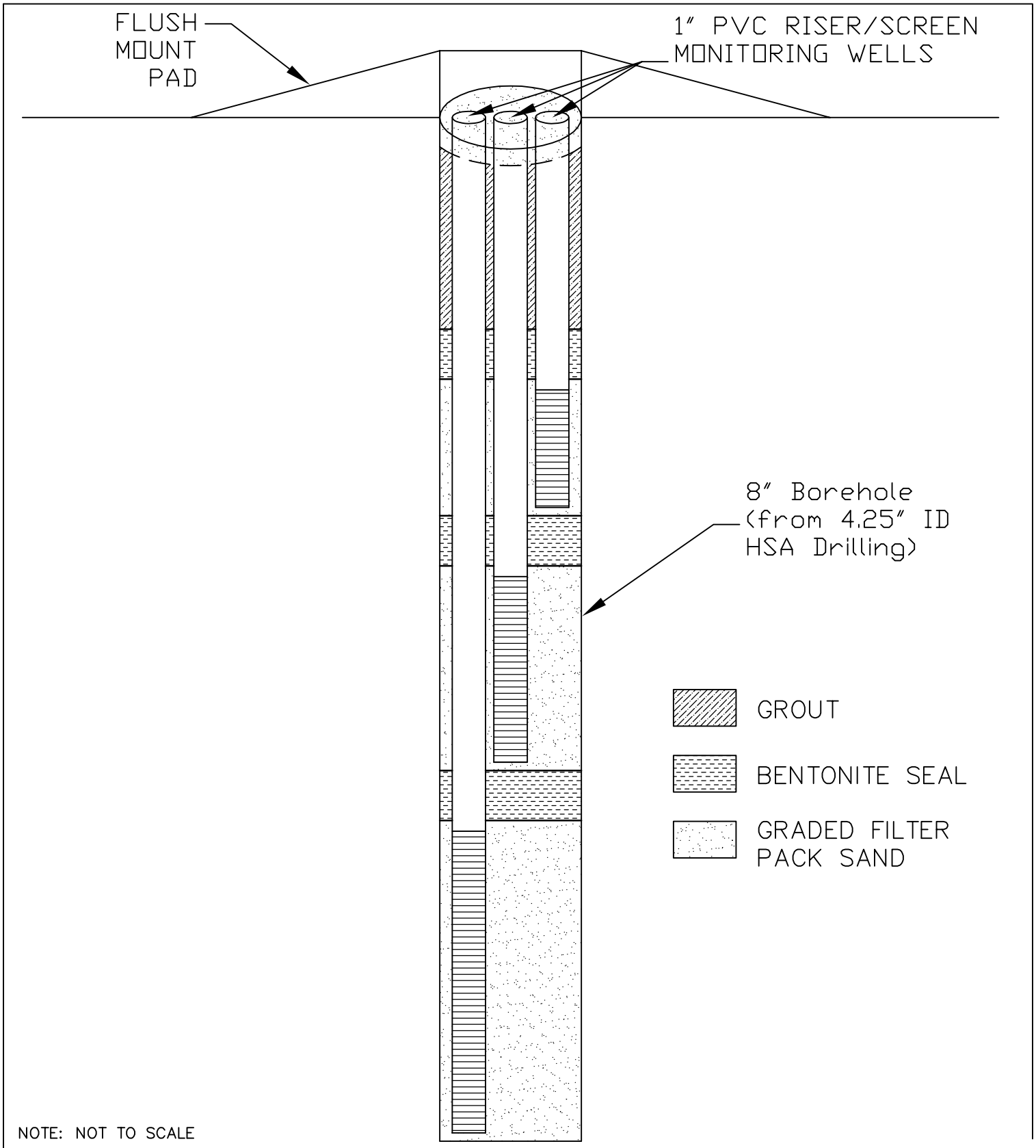
PROPOSED GROUNDWATER MONITORING WELL LOCATIONS

PENINSULA BOULEVARD GROUNDWATER PLUME

DATE 03-02-10

FIGURE 1

C:\PWworking\PITT\d0202306\Site Plan Figures.dwg, Figure 1, 3/2/2010 10:37:09 AM, jwynohra, Tabloid, 1:1



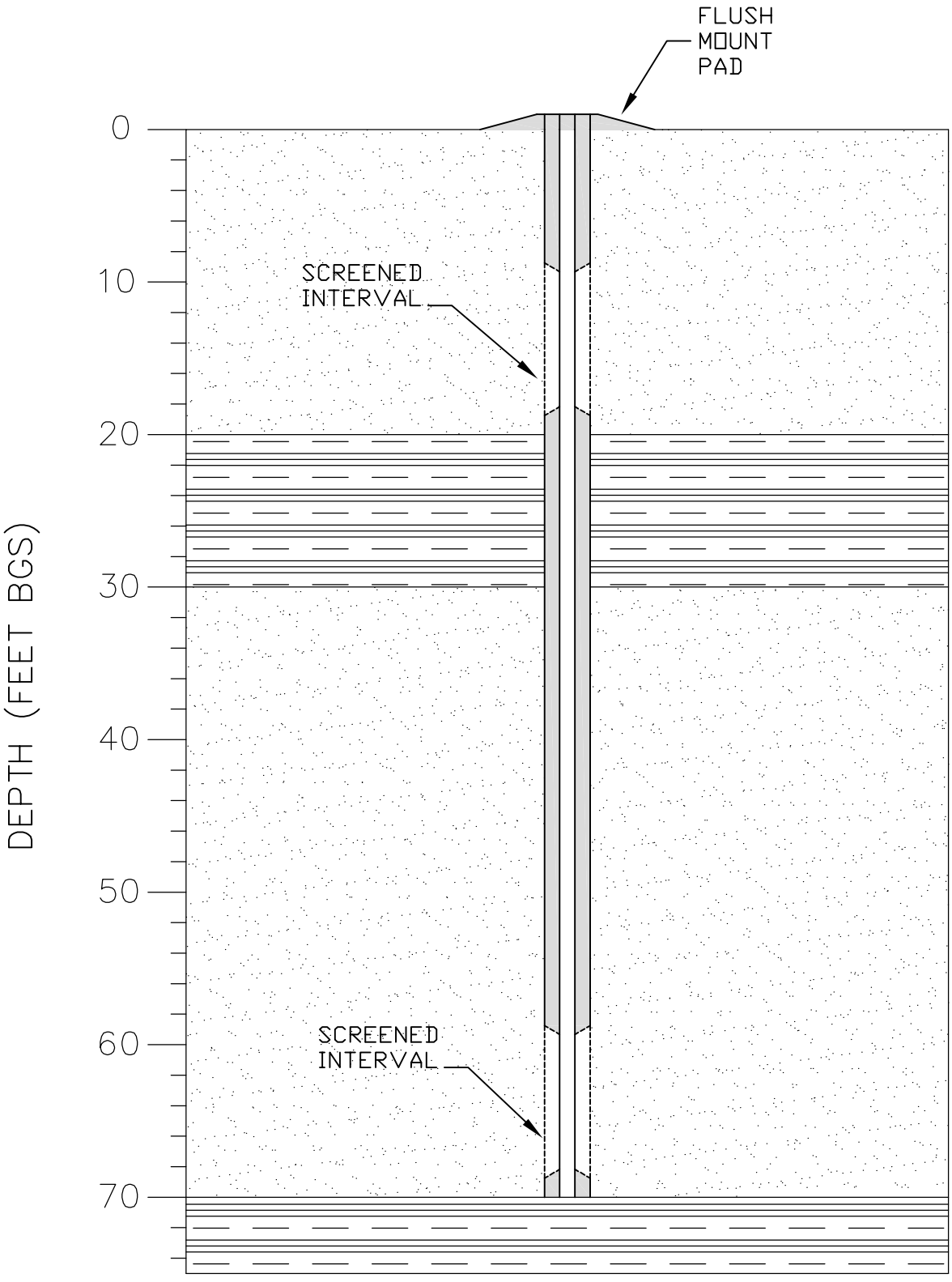
NOTE: NOT TO SCALE

HDR

MULTI-LEVEL MONITORING WELL CLUSTER

DATE
08-17-09

FIGURE
6



Note: CMT Multi-level Well as manufactured by Solinst™

HDR

SCHEMATIC DESIGN – CMT MULTI-LEVEL WELL

DATE
08-11-09

FIGURE
7

UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLANS

For
REGION 2 ARCHITECT-ENGINEERING SERVICES CONTRACT
CONTRACT #EP-W-09-009

PENINSULA BOULEVARD GROUNDWATER PLUME REMEDIAL INVESTIGATION/FEASIBILITY STUDY
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT, NASSAU COUNTY, NEW YORK
WORK ASSIGNMENT #002-RICO-02TV

Prepared For:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
290 BROADWAY, NEW YORK, NY 10007

Prepared By:

HENNINGSON, DURHAM & RICHARDSON ARCHITECTURE & ENGINEERING, P.C.
ONE BLUE HILL PLAZA, PEARL RIVER, NY 10965

Date of Issue:
JANUARY 19, 2010

Date of Revision:
FEBRUARY 22, 2010

REVISION 1

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TABLE OF CONTENTS

UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLANS

FOR

PENINSULA BOULEVARD GROUNDWATER PLUME RI/FS

INTRODUCTION

The Uniform Federal Policy Quality Assurance Project Plan (UFP-QAPP) was developed by the Project Team to confirm that environmental data gathered will be consistent with data quality objectives (DQOs) defined for this phase of the Peninsula Boulevard Groundwater Plume project. The UFP-QAPP was prepared in accordance with the following guidance document:

- Intergovernmental Data Quality Task Force (IDQTF) *Uniform Federal Policy for Quality Assurance Project Plans, Final, Version 1* (UFP-QAPP) dated March 2005.

The UFP-QAPP was developed as a joint initiative between the United States Environmental Protection Agency (EPA), Department of Defense (DoD), and Department of Energy (DoE). Its purpose is to provide a single national consensus document for consistently and systematically implementing the project-specific requirements for Section 6 (Part B) of American National Standards Institute/American Society for Quality (ANSI/ASQ) *Quality Systems for Environmental Data and Technology Programs - Requirements with Guidance for Use,* ANSI/ASQ E4 (February 2004) across the Federal agencies involved in the IDQTF. It is consistent with EPA's Guidance for Quality Assurance Project Plans (EPA QA/G-5) dated December 2002 and *Requirements for Quality Assurance Project Plans* (EPA QA/R-5) dated March 2001. Additionally, implementation of the UFP-QAPP helps to ensure the quality, objectivity, utility, and integrity of environmental information that the Federal government disseminates as required by the *Information Quality Guidelines Staff* (EPA/260R-02-008) dated October 2002.

A series of worksheets were completed (following Part 2A of the UFP-QAPP) for this project. Each worksheet addresses specific requirements of the UFP-QAPP.

As noted in a Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC) in March 2003, the operations of the former Grove Cleaners at 1274 Peninsula Boulevard from 1987 – 1992 resulted in the disposal of hazardous wastes to the

environment, including tetrachloroethylene (PCE) and trichloroethylene (TCE). The Nassau County Department of Health (NCDH) cited Grove Cleaners in March 1991 for discharging hazardous waste into on-site dry wells. Tetrachloroethene (PCE) was detected in soil and sludge samples collected at the site, and in other media at and near the former Grove Cleaners site. The New York State Department of Environmental Conservation (NYSDEC) became involved in 1992 and classified the Grove Cleaners site as a Class 2 Inactive Hazardous Waste Disposal Site in March 1993 (USEPA NPL website, 2004).

A series of investigations and removal actions from 1991 to 1999 (on behalf of the property owner, and later on behalf of NYSDEC) resulted in the completion of a Focused Remedial Investigation (FRI) by TAMS Consultants, Inc. (TAMS) and GZA GeoEnvironmental of New York (GZA). The results of the FRI indicated an extensive plume of groundwater located north and south of Peninsula Boulevard, primarily impacted by PCE. In addition, the results of the FRI suggested the potential for additional source areas other than the former Grove Cleaners site (TAMS/GZA, 2002).

A No Further Action remedy was selected by NYSDEC for the former Grove Cleaners site, following the implementation of interim remedial measures (IRMs). The EPA assumed responsibility for the (larger) Peninsula Boulevard Groundwater Plume Site in September 2002. A Hazard Ranking System Package (HRSP) was prepared in March 2004, and the Site scored 50 of a possible 100 points, placing the Site on the National Priorities List (NPL) in August 2004.

TtFW, under EPA Contract Number 68-W-98-214, conducted work on the Peninsula Boulevard Groundwater Plume Site project that included, but was not necessary limited to: development and finalization of RI/FS Work Plan (final document dated April 2005); implementation of site characterization work including environmental sampling and hydrogeological analyses, and associated data interpretation; submittal of a Data Evaluation Report (October 2008).

The RI/FS tasks provided in the May 28, 2009 EPA Statement of Work (SOW) are described in detail in the August 2009 HDR Work Plan. Activities for the RI/FS will include a review of the background materials; oversight of the installation of six new monitoring wells; collection of groundwater samples at the existing 20 wells; collection of groundwater and soil samples at the new monitoring wells; data evaluation; conducting risk assessments and establishing risk reduction goals; identifying and screening remedial alternatives; and preparation of RI and FS deliverables.

QAPP Worksheet #1
(UFP-QAPP Section 2.1)
Title and Approval Page

Site Name/Project Name: Peninsula Boulevard Groundwater Plume Superfund Site RI/FS
Site Location: Town of Hempstead, Village of Hewlett, Nassau County, NY

Document Title: Quality Assurance Project Plan – RI/FS

Lead Organization: United States Environmental Protection Agency, Region 2

Preparer's Name and Organizational Affiliation: Melissa LaMacchia, HDR

Preparer's Address, Telephone Number, and E-mail Address:
One Blue Hill Plaza, Floor 12, Pearl River, NY 10965
(845) 735-8300 ext. 315
Melissa.LaMacchia@hdrinc.com

Preparation Date (Day/Month/Year): February 22, 2010

HDR Project Manager/Date: _____
Signature

Printed Name/Organization: Michael Musso/HDR

HDR QA Manager/Date: _____
Signature

Printed Name/Organization: Richard McCollum/HDR

EPA Project Manager/Date: _____
Signature

Printed Name/Organization: Gloria Sosa/EPA

EPA QA Manager/Date: _____
Signature

Printed Name/Title: Linda Mauel/Section Chief, DESA/HWSB/HWSS

Document Control Numbering System 002-RICO-02TV-1.7-0

QAPP Worksheet #2 (UFP-QAPP Section 2.2.4)
QAPP Identifying Information

Site Name/Project Name: Peninsula Boulevard Groundwater Plume RI/FS
Title: QAPP – RI/FS
Site Location: Hewlett, Nassau County, NY
Revision Number: 1
Site Number/Code: EPA ID# NYN000204407
Revision Date: February 12, 2010
Operable Unit: N/A
Page 3 of 42
Contractor Name: HDR
Contract Number: EP-W-09-009

Contract Title: Architect-Engineer Contract for EPA Region 2 RAC2
Work Assignment Nos.: 002-RICO-02TV
Guidance Used to Prepare QAPP: UFP Manual, March 2005

1. Identify regulatory program: United States Environmental Protection Agency – Region 2

2. Identify approval entity: United States Environmental Protection Agency – Region 2

3. The QAPP is (select one): ☐Generic ☒Project Specific

4. List dates of scoping sessions that were held: July 8, 2009

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Date
TetraTech Inc. Work Plan for RI/FS Peninsula Boulevard Groundwater Plume. Appendix A QAPP.	April 2005

6. List organizational partners (stakeholders) and connection with lead organization:
HDR – prime contractor for EPA
EPA – lead agency
NYSDEC – state agency

7. List data users: HDR, EPA and NYSDEC.

8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below: No exclusions.

QAPP Worksheet #2 QAPP Identifying Information (continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	#1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	#2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	#3 and #4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	#5, #6, #7, #8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	#9 and #10 Minutes for each meeting maintained in project file See RI/FS Work Plan
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	#11 and #12

QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	#13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/TimelineTable	#14, #15, #16
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.3 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.4 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	#17 thru #22 Figure 1 See RI/FS Work Plan Attachment A
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	#23 thru #25 Attachment B (CLP)

QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Required Documents
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	#26 and #27 Attachment C
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	#28
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	#29 and #30
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	#31 and #32 Attachments D & E
4.2 QA Management Reports	- QA Management Reports Table	#33 Attachment F
4.3 Final Project Report		#33

QAPP Worksheet #2
QAPP Identifying Information
(continued)

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	#34 thru #37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining		Not Applicable

QAPP Worksheet #3
(UFP-QAPP Manual Section 2.3.1)

Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Gloria Sosa	Work Assignment Manager (WAM)	EPA, Region 2	(212) 637-4283	(212) 637-4284	Sosa.Gloria@epa.gov	002-RICO-02TV-1.7-0
Michael Musso	Project Manager	HDR	(845) 735-8300	(845) 735-7466	Michael.Musso@hdrinc.com	002-RICO-02TV-1.7-0
Richard McCollum	QA/QC Manager	HDR	(816) 360-2797	(816) 360-2777	Richard.McCollum@hdrinc.com	002-RICO-02TV-1.7-0
Carol Zurlo	Project Scientist	HDR	(845) 735-8300	(845) 735-7466	Carol.Zurlo@hdrinc.com	002-RICO-02TV-1.7-0
Scott Englert	Field Team Leader/Hydrogeologist	HDR	(518) 937-9500	(518) 937-9555	Scott.Englert@hdrinc.com	002-RICO-02TV-1.7-0
Tom Fowler	Geolgist	HDR	(845) 735-8300	(845) 735-7466	Thomas.Fowler@hdrinc.com	002-RICO-02TV-1.7-0
Brian Montroy	Geologist	HDR	(845) 735-8300	(845) 735-7466	Brian.Montroy@hdrinc.com	002-RICO-02TV-1.7-0
Linda Mauel	Section Chief	DESA/HWSB/HWSS	(732) 321-6766	(732) 321-6622	mauel.linda@epa.gov	002-RICO-02TV-1.7-0

QAPP Worksheet #4

(UFP-QAPP Manual Section 2.3.2)

Copies of this form shall be signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described. Each organization shall forward signed sheets to the Project Manager. Project files shall be maintained electronically within the respective project file on HDR ProjectWise.

Project Personnel Sign-Off Sheet

Organization: EPA, Region 2

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Gloria Sosa	WAM	(212) 637-4283		

Organization: HDR

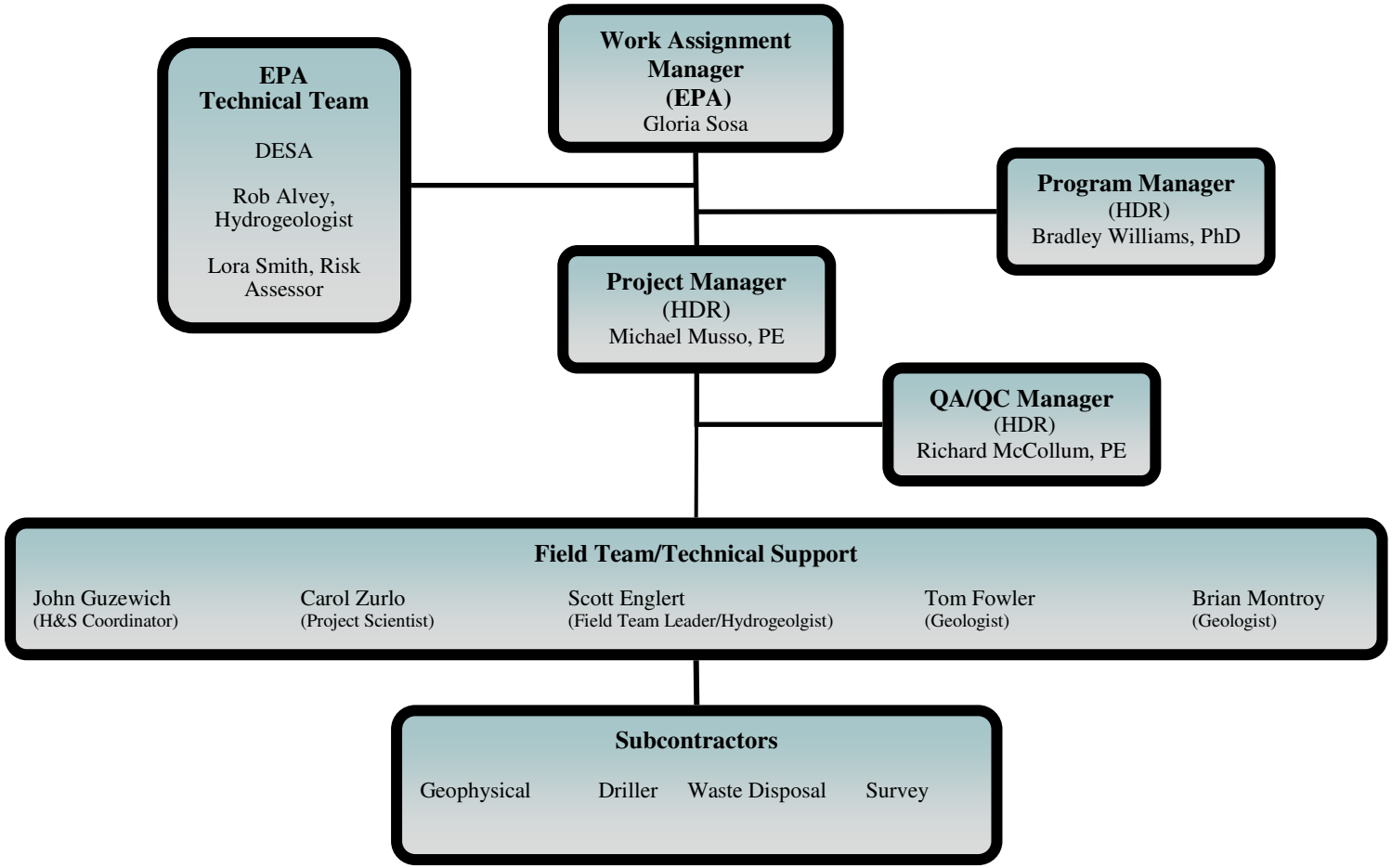
Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Micheal Musso	Project Manager	(845) 735-8300		
Richard McCollum	QA/QC Manager	(816) 360-2797		
Carol Zurlo	Project Scientist	(845) 735-8300		
Scott Englert	Field Team Leader/Hydrogeologist	(518) 937-9500		
Tom Fowler	Geolgist	(845) 735-8300		
Brian Montroy	Geolgist	(845) 735-8300		

Organization: EPA, DESA/HWSB/HWSS

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Linda Mauel	Section Chief/QAPP Reviewer	(732) 321-6766		

QAPP Worksheet #5
(UFP-QAPP Manual Section 2.4.1)

Project Organization Chart



QAPP Worksheet #6
(UFP-QAPP Manual Section 2.4.2)

Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of contact with EPA WAM; Manage all project phases	HDR	Michael Musso, Project Manager	(845) 735-8300	Liaison with EPA. All major problems reported to EPA within 24 hours of detection. Will work closely with members of the project team to understand any problems that arise on the project and will have ultimate authority to stop work. Will consult with members of the project team to correct deficiencies and ensure appropriate actions are taken before work is re-started.
Quality Assurance/Corrective Actions	HDR QA Manager	Richard McCollum	(816) 360-2797	Ensure that QC procedures are properly prescribed, implemented and assessed as outlined in the HDR QMP and QAPP; Work with the HDR Project Manager on major project issues and corrective actions.
Problems/changes and corrective actions in the field. Daily Quality Control Reports	HDR	Scott Englert, Field Team Leader	(518) 937-9500	Will work with the Project Manager on major project issues and corrective actions. Project issues/problems reported to the PM within 12 hours of detection. DQCRs forwarded to the PM within 24 hours.
Laboratory Analysis Problems	EPA Region 2 RSCC	Adly Michael, RSCC	(732) 632-4766	Laboratory analysis problems are reported to the EPA WAM within 24 hours of detection.

QAPP Worksheet #7
(UFP-QAPP Manual Section 2.4.3)

Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Gloria Sosa*	Remedial PM/WAM	EPA	Ultimate project authority for EPA	As required for the project
DESA EPA Technical Team: Rob Alvey* Lora Smith* Others*	QA, Chemist Hydrogeologist Risk Assessor TBD	EPA	Provide project support to EPA	As required for the project
Michael Musso*	Project Manager	HDR	Liaison to EPA WAM; overall project management and oversight; budget responsibility; monitor delivery schedules	BS Civil Engineering MS Environmental Engineering Master of Public Health Over 17 years environmental consulting experience
Richard McCollum*	QA/QC Manager	HDR	Provide overall QA/QC of project; ensure implementation of the QAPP	BS Civil Engineering Over 35 years environmental consulting experience
John Guzewich*	H&S Coordinator	HDR	Oversee H&S for field activities	BS in Environmental Science Over 28 years environmental consulting experience
Scott Englert* Carol Zurlo* Tom Fowler* Brian Montroy*	Field Staff	HDR	Perform field activities and provide project support as needed	MS Hydrogeology (Englert) Each individual having a BS in Environmental Sciences/Engineering/Geology and at least 3 years of field experience

* Indicates a project team member.

QAPP Worksheet #8

(UFP-QAPP Manual Section 2.4.4)

All project staff will be properly trained and certified for the project and possess the appropriate technical degrees and years of experience needed to complete project tasks. Required training and documentation of training shall be described in the Site-specific Health and Safety Plans (HASPs).

Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Sampling/Inspecting Hazardous Waste Sites	40 Hour HAZWOPER Training/8 hr Annual Refresher	Compliance Solutions	Current	Field Staff	Project Scientists/HDR	HDR Offices
Sampling/Inspecting Hazardous Waste Sites	First Aid/CPR	HDR	Every 2 years	Field Staff	Project Scientists/HDR	HDR Offices Personnel File
Sampling/Inspecting Hazardous Waste Sites	Medical Clearance	HDR	Every 2 years	Field Staff	Project Scientists/HDR	HDR Offices Personnel File
Sampling/Inspecting Hazardous Waste Sites	OSHA Site Supervisor	External	As Needed	Field Team Leader	Project Scientists/HDR	HDR Offices Personnel File
Sampling/Inspecting Hazardous Waste Sites	Other	TBD	As Required	TBD		

QAPP Worksheet #9
(UFP-QAPP Manual Section 2.5.1)

Additional worksheets will be prepared for each project scoping session held, as applicable.

Project Scoping Session Participants Sheet

Project Name: RI/FS **Projected Date(s) of Sampling:** March to April 2010 **Project Manager:** Michael Musso	**Site Name:** Peninsula Boulevard Groundwater Plume **Site Location:** Hewlett, Nassau County, NY
Date of Session: July 8, 2009 **Scoping Session Purpose:** Project Planning Meeting – In person at EPA	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
John J Bachmann Jr	Contracting Officer	EPA	(212) 637-3363	Bachmann.johnj@epa.gov	Contracting Officer
Keith Moncino	Project Officer	EPA	(212) 637-4353	Moncino.keith@epa.gov	Project Officer
Gloria Sosa	WAM	EPA	(212) 637-4283	Sosa.Gloria@epa.gov	Project Management
Kevin Lynch	Section Chief	EPA	(212) 637-4287	Lynch.Kevin@epa.gov	Oversight of WAM
Rob Alvey	Hydrogeologist	EPA	(212) 637-3258	Alvey.Robert@epa.gov	Technical Lead
Lora Smith	Risk Assessor	EPA	(212) 637-4299	Smith.Lora@epa.gov	Technical Lead
Brad Williams	Program Manager	HDR	(845) 735-8300	Bradley.Williams@hdrinc.com	Oversight of PM
Michael Musso	Project Manager	HDR	(845) 735-8300	Michael.Musso@hdrinc.com	Project Management
Rich McCollum	QA/QC Manager	HDR	(816) 360-2797	Richard.McCollum@hdrinc.com	QA/QC
Carol Zurlo	Project Scientist	HDR	(845) 735-8300	Carol.Zurlo@hdrinc.com	Technical Support

Comments/Decisions:

Task 1.3 – Site Visit M. Musso will coordinate a July 2009 site visit with G. Sosa.
Task 1.4 – Develop Draft Work Plan and Associated Cost Estimate:

- A **Technical Meeting**, and a **Technical Memorandum** from HDR, are needed prior to the submittal of the Draft RI/FS Work Plan for purposes of outlining potential deviations (additions) to the SOW.

- HDR will compare the SOW with the recommendations from TetraTech's DER. HDR will identify and assess possible data gaps, and outline for discussion during the technical meeting.
- Lateral delineation of the plume is not a top priority, per the EPA, due to the lower concentrations of contaminants near the plume edges, and considering the known groundwater flow direction and plume limit. Lateral delineation could be left as a pre-design task for the RA.
- G. Sosa noted that questions or comments on previous investigation work should be discussed with her. She also offered that a draft Work Plan table of contents (as it is assembled) can be discussed with her as the Work Plan document is being drafted.
- As per K. Moncino, the number of subcontractors assumed for the RI/FS work can vary from that noted in the SOW (Task 1.11 says to assume three subcontractors). Comment noted by HDR for Work Plan and Cost Estimate development. It was discussed that subcontractors may include driller, surveyor, geophysical (mark-out), IDW disposal.
- Access Agreements were discussed. Existing access agreements are still in force (or otherwise pursued by EPA directly). G. Sosa noted that for prior site work, significant time (months) was sometimes required for access coordination. HDR to coordinate future access needs with G. Sosa, who will in turn coordinate with attorney (as required). It was noted by all that access agreements are typically obtained faster for right-of-way locations (as compared with private properties).

Task 1.5 - Negotiations:

- EPA confirmed that the Work Plan budget should include all of the tasks outlined on the statement of work (i.e., Task 1 through Task 16). All assumptions must be clearly identified in the Work Plan and budget estimate.

Deliverables were discussed:

- G. Sosa clarified that HDR is to prepare in the future a **Data Evaluation Report (DER) Addendum** (to TetraTech's DER) and a (separate, all-encompassing) **Remedial Investigation Report** which consolidates the historic data found in the EPA-provided reports with HDR's work.
- Human Health Risk Assessment (HHRA) – minimal work has been conducted to date to assess potential human health risks at the site; hence, a **Pathway Analysis Report** will be prepared. The Pathway Analysis Report will serve as a template and scoping item for the future HHRA task. The SOW deliverables schedule notes that the Pathway Analysis Report is to be submitted after HDR's data evaluation report; however, HDR should begin assessing pathways sooner.
- It is probable that the pathway analysis (and future HHRA) will <u>not</u> need to include a detailed evaluation of the potable water pathway, since a recognized, engineering control is in-place, maintained, and monitored by the Long Island Water Corporation (LIWC). To confirm that this particular pathway is "incomplete", HDR will work with G. Sosa to collect and review the LIWC's data. A meeting with LIWC will try to be arranged by EPA in the future.
- EPA has conducted indoor air testing (12-13 homes assessed so far) and will continue to manage these efforts to further assess potential vapor intrusion (VI). One home reportedly had elevated concentrations, and a SSD system will be installed in this home. G. Sosa to provide a summary of the past and on-going EPA work regarding VI at the site. At minimum, VI information will be acknowledged by reference in future HDR documents (Pathway Analysis Report; HHRA).

The site visit will include a visit to the home where the SSD system is proposed (exterior visit only). G. Sosa noted that she would like to complete more VI work on behalf of the project (sub-slab and indoor air testing this winter).

- Ecological Risk Assessment. A screening-level ecological risk assessment (SLERA) will be conducted. M. Musso noted that some limited data exists which can be utilized for the SLERA. A "tiered" approach will be implemented, so that findings can be discussed with EPA and a decision can be made if more work is required.
- There is no CRP (community relation plan) and one is required as part of the SOW. A public meeting is needed (possibly late 2009 or early 2010), since there has not been any held for an extended period of time. G. Sosa hopes that public relations will provide additional opportunities to gain access to homes for VI assessment. EPA has a public relation coordinator that HDR should work with. G. Sosa noted that the CRP should include brief descriptions of RI/FS work and timetables.

Task 1.6 – Existing Data: HDR confirmed receipt of the electronic copies of two TetraTech documents: April 2005 RI/FS Work Plan and October 2008 Data Evaluation Report. In addition to the documents already provided to HDR, G. Sosa has the TAMS/GZA report (prior NYSDEC work) in her possession. She will provide HDR with the report/drawings in order to make copies; originals to be returned.

Task 1.7 and 1.8: G. Sosa noted the approved TetraTech QAPP. If HDR has any questions on reviewing and/or developing the QAPP and HASP documents, they should be directed to G. Sosa, who will then contact appropriate EPA personnel (i.e., Edison, NJ for QAPP).

Task 1.10 - Meetings: Assume all meetings will be at EPA headquarters (290 Broadway).

Action Items:

- HDR
  - Distribute July 8, 2009 meeting minutes within 5 calendar days
  - Prepare draft work plan within 45 calendar days
  - Send e-mail to coordinate site visit.
- EPA
  - Forward AutoCAD drawings, if available.
  - Forward indoor air and sub-slab sampling (VI) information.

QAPP Worksheet #10
(UFP-QAPP Manual Section 2.5.2)

Problem Definition

The problem to be addressed by the project: A Record of Decision (ROD) issued by the NYSDEC in March 2003 concluded that the operations of the former Grove Cleaners (1274 Peninsula Blvd) from 1987-1992 resulted in the disposal of hazardous wastes to the environment including trichloroethylene (TCE) and tetrachloroethylene (PCE). The former Grove Cleaners was cited by the Health Dept. in March 1991 for discharging hazardous waste to on-site dry wells. In March 1993 the Grove Cleaners site was classified as a Class 2 Inactive Hazardous Waste Disposal Site. A series of investigations and removal actions from 1991 to 1999 resulted in the completion of a Focused RI by TAMS Consultants and GZA GeoEnvironmental of New York. The results indicated an extensive groundwater plume exists north and south of Peninsula Blvd, primarily impacted by PCE, and also suggested additional sources of PCE contamination, other than the former Grove Cleaners site. TetraTech FW, Inc. (TtFW) conducted additional environmental sampling and hydrogeological analyses beginning in 2006. The goal of the current RI is to further evaluate the extent of the groundwater contaminant plume, attempt to identify sources of PCE contamination, further determine the fate and transport of site contaminants, and support the ecological and human health risk assessments and feasibility study. In addition, the RI will determine whether potential threats exist to the public health, welfare, or the environment caused by any release or potential release from the sites, and to also aid in the evaluation for remediation or control of such releases. Six (6) monitoring wells will be installed in the upper glacial overburden aquifer, four (4) of which will be screened at multiple levels (up to 2), to a total depth of approximately 70 ft. Proposed sample locations are shown on Figure 1. Soil samples will be collected from each location from depths to be determined based on field screening and PID/FID readings. Existing and newly installed wells will be sampled to further assess the extent of groundwater contamination.
The environmental questions being asked: The questions being asked of the RI are what is the extent of the groundwater contaminant plume? What are possible sources of PCE contamination? What is the impact of contamination on human health, welfare and the environment?
Alternative actions or outcomes that may result based on the answers to the key questions being asked: Based on the results of the RI, recommendations may be given for additional or supplemental investigative work.
Observations from any site reconnaissance reports: Remedial investigations and removal actions have been conducted/implemented at the site since 1987 by NYSDEC, EPA, and their respective environmental consultants including soil (surface, sub-surface, sewer trench and background), groundwater (shallow hydropunch, deep hydropunch, and monitoring wells), sludge, sediment, surface water, and indoor air. PCE was detected in several groundwater samples throughout the Site, with concentrations exceeding 5,000 ug/l. A summary of sample results detected by media is provided in HDR's Work Plan. TtFW concluded that a continuous area of PCE contamination exists in the shallow unconfined overburden aquifer. A "20 ft clay unit" was encountered that was attributed to possibly acting as a confining layer and causing the contamination to spread out laterally as opposed to vertically. Deep overburden groundwater samples were less than applicable criteria. A second plume was identified upgradient of the former Grove Cleaners site, where PCE was present in deeper monitoring wells, indicating other sources.
A synopsis of secondary data or information from site reports: Information from previous investigations has revealed the presence of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and/or metals in the media described above. The results have been summarized in HDR's RI Work Plan.

The possible classes of contaminants and the affected matrices: Potential affected media include surface and sub-surface soils, sediment, groundwater, surface water, and potable water for the following contaminants: VOCs, SVOCs, pesticides/PCBs, and/or metals with chlorinated VOCs being the primary contaminants of concern, in particular PCE and its breakdown products.
The rationale for inclusion of chemical and nonchemical analyses: Soil and groundwater samples will be analyzed for VOCs to gain a current understanding of contaminant concentrations. Soil samples (up to 2 per location) will be biased toward areas that exhibit contamination (as evidenced from visual, olfactory, or PID/FID readings) in the field. Groundwater samples will be collected from the screened interval at each of the well locations to assess shallow and semi-confined portions of the upper glacial overburden aquifer. Four of the newly installed wells will be screened at up to two locations (at approximately 25 ft and 60 ft) to gain an understanding of contaminant concentrations from multiple levels at the same location.
Information concerning various environmental indicators: Environmental indicators have been observed during previous investigations as summarized above.
Project decision conditions ("If..., then..." statements): The primary decision statement that can be generated for this project is, If groundwater data collected during the RI is sufficient to define the current extent of contamination and adequately characterize the source areas based upon the project action levels, then an understanding of the impact of contamination and risks to receptors can be understood and the appropriate remedial approach can be devised. The definition of the extent of contamination and characterization of the source areas will be based on comparisons of groundwater data to NYS and USEPA groundwater standards / screening levels. If contaminant levels found in groundwater during the RI exceed NYS and/or USEPA criteria, remedial alternatives will be identified and developed in the Feasibility Study for purposes of addressing the contamination.

QAPP Worksheet #11
(UFP-QAPP Manual Section 2.6.1)

Project/Data Quality Objectives / Systematic Planning Process Statements

Who will use the data? HDR, EPA Region 2 and NYSDEC.
What will the data be used for? Soil and groundwater analytical results will be used to assess the current extent of contamination. Collection of water level measurements from the newly installed and existing wells will be used to assess groundwater flow direction across the Site.
What type of data are needed? Groundwater samples will be collected from existing and newly installed monitoring wells using low flow purging and sampling techniques. Soil samples will be collected during the installation of the new wells. Samples will be analyzed for VOCs. Analysis of samples will aid in the assessment of the extent of contamination in affected media. Results will be definitive with the submittal of a Division of Environmental Science and Assessment (DESA)/Contract Laboratory Program (CLP)- validated data package. Appropriate QC samples will be collected as outlined in this QAPP.
How "good" do the data need to be in order to support the environmental decision? Soil and groundwater samples collected during the RI will be used for definitive purposes to assess the current extent of contamination and will be validated. The RI is a critical step in the planning process to assess current conditions (horizontal/vertical extent of plume and groundwater flow), identify other possible sources, and support the ecological and human health risk assessments and feasibility study. The data need to be of sufficient quality to verify that results were obtained using applicable processes and protocols and are adequate in satisfying the project DQOs.
How much data are needed? Up to two (2) soil samples will be collected from each of the newly installed wells at depths to be determined in the field based on visual and olfactory observations as well as PID/FID readings and will be biased toward areas exhibiting signs of contamination. Groundwater samples and water level measurements will be collected from 20 existing wells and 6 newly installed wells (4 of which will be screened over a maximum of 2 intervals – approx. 25 and 60 ft) and analyzed for VOCs, during the first round of sampling. A second round of groundwater sampling will be conducted that will include collecting samples for VOCs analysis from the newly installed wells only. The soil and groundwater action levels are the NYSDEC Unrestricted Use Soil Cleanup Objectives (Table 375-6.8(a)) and NYSDCE TOGS 1.1.1 Class GA standards and guidance values, respectively.
What are the spatial and temporal boundaries of the study? The spatial and temporal boundaries of the site have not yet been fully determined. The RI will aid in assessing the extent of contamination at the two identified groundwater plumes.
Where, when, and how should the data be collected/generated? RI sampling activities are slated to begin in March 2010. Soil samples will be collected during installation of the 6 newly installed wells. The first round of groundwater sampling will include 20 existing wells and the newly installed wells. A second round of groundwater sampling will be conducted that will include the newly installed wells only. (Field Standard Operating Procedures (SOPs), referenced below, are included in Attachment A.) The Field and Analytical Services Teaming Advisory Committee (FASTAC) process will be followed to procure laboratory services. HDR will supply the sample containers and preservatives for the samples to be collected which will be analyzed by DESA/CLP. • Soil samples will be collected using carbon or stainless steel split spoons using hollow stem augers in accordance with SOPs #8 and #31. VOCs samples will be collected using the Encore sampling system described in SOP #12. • PID will be used to screen soil samples in accordance with SOP #1 and #30. • Groundwater levels will be measured using handheld electronic water level indicators as described in SOP #15. • Groundwater wells will be sampled utilizing EPA low-purging and sampling protocols outlined in SOP #17.

Who will collect and generate the data? HDR will collect the soil and groundwater samples and DESA/CLP will analyze them.
How will the data be reported? The data will be reported in DESA/CLP format and data validation will be completed for all of the samples.
How will the data be used to meet the PQOs? The data will be used to gain a current understanding of the extent of contamination at the Site.
How will the data be archived? HDR will utilize EarthSoft's EQuIS software to manage and archive the data and for submittal to EPA. Hard copies of data reports will also be kept in the project file.

QAPP Worksheet #12
(UFP-QAPP Manual Section 2.6.2)

Data quality indicators (DQIs), measurement performance criteria (MPC), and QC sample and/or activity are used to assess the measurement performance for both the sampling and analytical measurement systems. DQIs include the PARCC (precision, accuracy, representativeness, comparability, and completeness) parameters; a method of assessing the validity of environmental data. Precision, accuracy, and completeness can be measured quantitatively based on techniques described below and in Worksheet #37. Representativeness and comparability are qualitative measurements.

Precision is a measure of the variation among individual measurements of the same sample i.e., the relative percent difference of the results obtained for a sample and a split/blind duplicate sample collected at the same time and in the same way as the original sample.

Accuracy is a measure of the distortion of a measurement from its true value i.e., the percent recovery of a sample spiked with a known concentration of the analytes being tested for (matrix spike/matrix spike duplicate).

Representativeness is a measure of how closely the results received reflect the actual concentrations or distribution of compounds in a sample, as well as field conditions and environmental conditions. Sampling plan design, sample collection techniques, and sample handling protocols have been developed to ensure the collection of representative samples. Field and laboratory blanks will be analyzed to assess sample contamination.

Comparability expresses the confidence with which one data set can be compared to another. To ensure comparability, standard operating/sampling procedures will be followed.

Completeness is a measure of the number of samples collected versus the number of samples analyzed. Data completeness determines whether planned DQOs have been satisfied and is based upon the usability calculation; described further in Worksheet #37.

The following tables summarize the EPA's DESA laboratory's MPCs for the Peninsula Boulevard Groundwater Plume site. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP MPCs are included in Attachment B.

QAPP Worksheet #12
(UFP-QAPP Manual Section 2.6.2)

Measurement Performance Criteria Table

Matrix	Aqueous
Analytical Group	VOA
Concentration Level	Trace

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP #17	DW-1	Precision	% RPD < 20 ±50% RPD	Laboratory Control Sample (LCS) Duplicate Field Duplicate	A S&A
SOP #17	DW-1	Accuracy	Average Recovery (80-120%)		A
SOP #17	DW-1	Accuracy	+/- 40% from the initial/continuing calibration	Internal standards	A
SOP #17	DW-1	Accuracy	Limits 70%-130%	Matrix spike	A
SOP #17	DW-1	Accuracy	Limits 80%-120%	Surrogate Compounds	A
SOP #17	DW-1	Accuracy	< RL	Method Blank	A
SOP #17	DW-1	Representativeness	<CRQL; except for methylene chloride, acetone, and 2-butanone, which must be 2 times the CRQL	Trip Blank Field Blank	S&A
SOP #17	DW-1	Completeness	95% usable for VOC data	Usability calculation	S&A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2).
[2]Reference number from QAPP Worksheet #23 (see Section 3.2).

Matrix	Soil
Analytical Group	VOA
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP**[2]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
SOP #17, SOP #12	C-123	Precision Precision Accuracy	±50% RPD (Soil) Average Recovery 70-130%	LCS Duplicate Field Duplicate	A S&A
SOP #17, SOP #12	C-123	Accuracy	Factor of two(-50% to + 100%) from the initial/continuing calibration	Internal standards	A
SOP #17, SOP #12	C-123	Accuracy	Compound Specific (full range: 17-259%)	Matrix spike	A
SOP #17, SOP #12	C-123	Accuracy	Table 7 of C-123(low Soil)	Surrogate Compounds	A
SOP #17, SOP #12	C-123	Accuracy	< RL	Method Blank	A
SOP #17, SOP #12	C-123	Representativeness	<CRQL; except for methylene chloride, acetone, and 2-butanone, which must be 2 times the CRQL	Field Blank	S&A
SOP #17, SOP #12	C-123	Comparability	95% usable for VOC data	Usability calculation	S&A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2).
[2]Reference number from QAPP Worksheet #23 (see Section 3.2).

QAPP Worksheet #13
(UFP-QAPP Manual Section 2.7)

Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Final Remedial Investigation Report	TAMS Consultants, Inc. and GZA GeoEnvironmental of New York, Final Remedial Investigation Grove Cleaners, February 2002	TAMS and GZA, Subsurface soil, Groundwater, Soil Gas, Storm Drain/Dry Well, Surface Water and Sediment Sampling, VOCs/March 2000 to October 2001	Document was reviewed for background information and was the basis for the previous consultant's (TetraTech, Inc.) work plan.	The age of the data is a limiting factor. The findings of the RI for Grove Cleaners revealed upgradient contamination/additional sources of contamination and was integral in the Peninsula Blvd site being listed on the NPL. The data presented during the RI is not comprehensive in determining the extent of contamination associated with the site.
Final RI/FS Work Plan	TetraTech, Inc., Final RI/FS Work Plan Peninsula Blvd Groundwater Plume RI/FS, April 2005.	TetraTech, Inc., Proposed collection of Surface and subsurface soils, Groundwater, Surface Water, Sediment samples for TCL Organics, TAL Metals, TOC, grain size.	Document was used for background information on initial RI activities.	Document was prepared by others.
Data Evaluation Report	TetraTech, Inc., Data Evaluation Report for Peninsula Blvd Groundwater Plume RI/FS, October 2008.	TetraTech, Inc., Surface and subsurface soils, Groundwater, Surface Water, Sediment samples for TCL Organics, TAL Metals, TOC, grain size/August 2006 to November 2007.	Data used as background information for the site and as basis for additional sampling proposed during the present RI.	Data was collected by others.

QAPP Worksheet #14
(UFP-QAPP Manual Section 2.8.1)

Summary of Project Tasks

Sampling Tasks: Sample 20 existing wells (one round) and 6 newly installed wells (two rounds) for VOCs to determine the extent of contamination. Sample soil at each newly installed well (estimated maximum 2 samples/location) for VOCs. See Worksheet #17 and #18.
Analysis Tasks: Soil, groundwater, and QA/QC samples will be packaged and processed by HDR for shipment to DESA/CLP. DESA/CLP will analyze the samples for VOCs.
Quality Control Tasks: Implement SOPs (Worksheet #21) for Encore sampling of soils, low flow purging and sampling of groundwater, and utilization of field instrumentation. QC samples are described in Worksheet #28.
Secondary Data: See Worksheet #13.
Data Management Tasks: Electronic Data Deliverables (EDDs) provided by DESA/CLP will be uploaded into the EQuIS database. Data will be validated by DESA/CLP. HDR will evaluate, tabulate and depict data on figures, as appropriate, for presentation in the project report. HDR will prepare EDDs for field sampling and laboratory analytical results, geologic data, and well and location data in accordance with the EPA's Comprehensive Electronic Data Deliverable Specification Manual.
Documentation and Records: All samples collected will be recorded on field sheets or in the field logbook. Chains of custody (COCs), airbills, and field measurement logs (air and groundwater quality instrumentation field readings and calibration data) will be prepared and retained for each sample/day in the field datasheets. See Worksheet #29.
Assessment/Audit Tasks: Field data records (logs, COCs, calibration sheets) will be reviewed on a daily basis for completeness and accuracy by the Field Team Leader. Field audits will be conducted by HDR during the course of the investigation to ensure that subcontractors and HDR field staff are performing RI activities in accordance with the RI Work Plan, QAPP, and HASP. Laboratory audits are not necessary as DESA/CLP will be analyzing the samples. See Worksheet #31.
Data Review Tasks: DESA/CLP will verify that all data are complete for samples received. All data package deliverable requirements will be met. Full validation of the data will be performed by DESA/CLP using EPA Region 2 data validation SOPs. Achievement of all project-specific measurement performance criteria as specified in the QAPP and data validation criteria will be evaluated during the data validation process and analytical measurement error will be assessed. Validated data and all related field logs/notes/records will be reviewed to assess the total measurement error and determine overall usability of the data for project purposes. Data limitations will be determined and data will be compared to the required action levels. Corrective actions will be initiated as necessary. Final data are placed in the database with any necessary qualifiers and tables, charts and graphs are generated. See Worksheets #34-36.

QAPP Worksheet #15
(UFP-QAPP Manual Section 2.8.1)

The following tables summarize DESA Reference Limits and Evaluations for the Peninsula Boulevard Groundwater Plume RI/FS. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP RLs are included in Attachment B.

Matrix:	Aqueous
Analytical Group:	Volatile Organic Compounds
Concentration Level:	Trace

Analyte	CAS Number	Project Action Limits ug/l	Method CRQLs	Achievable Laboratory (DESA) Limits MDLsug/l	RLs
Dichlorodifluoromethane	75-71-8	5	0.5 µg/L	0.11	0.5 µg/L
Chloromethane	74-87-3	5	0.5 µg/L	0.07	0.5 µg/L
Vinyl Chloride	75-01-4	2	0.5 µg/L	0.12	0.5 µg/L
Bromomethane	74-83-9	5	0.5 µg/L	0.14	0.5 µg/L
Chloroethane	75-00-3	5	0.5 µg/L	0.14	0.5 µg/L
Trichlorofluoromethane	75-69-4	5	0.5 µg/L	0.11	0.5 µg/L
1,1-Dichloroethene	75-35-4	5	0.5 µg/L	0.10	0.5 µg/L
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5	0.5 µg/L		0.5 µg/L
Carbon Disulfide	75-15-0	60 GV	0.5 µg/L	0.10	0.5 µg/L
Acetone	67-64-1	50 GV	5 µg/L	0.36	5 µg/L
Methyl Acetate	79-20-9		0.5 µg/L		0.5 µg/L
Methylene Chloride	75-09-2	5	0.5 µg/L	0.18	0.5 µg/L
trans-1,2-Dichloroethene	156-60-5	5	0.5 µg/L	0.09	0.5 µg/L
cis-1,2-Dichloroethene	156-59-2	5	0.5 µg/L	0.06	0.5 µg/L
Methyl tert-Butyl Ether	1634-04-4	10 GV	0.5 µg/L	0.03	0.5 µg/L
1,1-Dichloroethane	75-34-3	5	0.5 µg/L	0.08	0.5 µg/L
2-Butanone	78-93-3	50 GV	5 µg/L	0.21	5 µg/L
Chloroform	67-66-3	7	0.5 µg/L	0.07	0.5 µg/L
1,2-Dichloroethane	107-06-2	0.6	0.5 µg/L	0.09	0.5 µg/L

1,1,1-Trichloroethane	71-55-6	5	0.5 µg/L	0.09	0.5 µg/L
Cyclohexane	110-82-7		0.5 µg/L		0.5 µg/L
Carbon Tetrachloride	56-23-5		0.5 µg/L	0.10	0.5 µg/L
Benzene	71-43-2	1	0.5 µg/L	0.07	0.5 µg/L
Trichloroethene	79-01-6	5	0.5 µg/L	0.08	0.5 µg/L
Methylcyclohexane	108-87-2		0.5 µg/L		0.5 µg/L
1,2-Dichloropropane	78-87-5	1	0.5 µg/L	0.04	0.5 µg/L
Bromodichloromethane	75-27-4	50 GV	0.5 µg/L	0.06	0.5 µg/L
cis-1,3-Dichloropropene	10061-01-5	0.4 (sum)	0.5 µg/L	0.05	0.5 µg/L
trans-1,3-Dichloropropene	10061-02-6	0.4 (sum)	0.5 µg/L	0.04	0.5 µg/L
1,1,2-Trichloroethane	79-00-5	1	0.5 µg/L	0.08	0.5 µg/L
Dibromochloromethane	124-48-1	50 GV	0.5 µg/L	0.03	0.5 µg/L
4-Methyl-2-Pentanone	108-10-1		5 µg/L	0.10	5 µg/L
Toluene	108-88-3	5	0.5 µg/L	0.08	0.5 µg/L
1,2-Dibromoethane	106-93-4		0.5 µg/L	0.04	0.5 µg/L
Chlorobenzene	108-90-7	5	0.5 µg/L	0.06	0.5 µg/L
Tetrachloroethene	127-18-4	5	0.5 µg/L	0.09	0.5 µg/L
2-Hexanone	591-78-6	50 GV	5 µg/L	0.11	5 µg/L
Ethylbenzene	100-41-4	5	0.5 µg/L	0.06	0.5 µg/L
m,p-Xylene	179601-23-1	5 (each)	0.5 µg/L	0.13	0.5 µg/L
o-Xylene	95-47-6	5	0.5 µg/L	0.05	0.5 µg/L
Styrene	100-42-5	5	0.5 µg/L	0.03	0.5 µg/L
Bromoform	75-25-2	50 GV	0.5 µg/L	0.07	0.5 µg/L
Isopropylbenzene	98-82-8	5	0.5 µg/L	0.06	0.5 µg/L
1,1,2,2-Tetrachloroethane	79-34-5	5	0.5 µg/L	0.05	0.5 µg/L
1,3-Dichlorobenzene	541-73-1	3	0.5 µg/L	0.05	0.5 µg/L
1,4-Dichlorobenzene	106-46-7	3	0.5 µg/L	0.03	0.5 µg/L
1,2-Dichlorobenzene	95-50-1	3	0.5 µg/L	0.04	0.5 µg/L
1,2-Dibromo-3-Chloropropane	96-12-8	0.04	0.5 µg/L	0.18	0.5 µg/L
1,2,4-Trichlorobenzene	120-82-1	5	0.5 µg/L	0.06	0.5 µg/L
1,2,3-Trichlorobenzene	87-61-6	5	0.5 µg/L	0.05	0.5 µg/L
Bromochloromethane	74-97-5	5	0.5 µg/L	0.10	0.5 µg/L

GV = Guidance Value

Matrix:	Soil
Analytical Group:	Volatile Organic Compounds
Concentration Level:	Low

Analyte	CAS Number	Project Action Limits ug/kg	Method QLs µg/kg	Achievable Laboratory (DESA) Limits MDLs µg/kg	RLs µg/kg
Dichlorodifluoromethane	75-71-8		5	0.7	5
Chloromethane	74-87-3		5	2.2	5
Vinyl Chloride	75-01-4	20	5	*	5
Bromomethane	74-83-9		5	1.3	5
Chloroethane	75-00-3		5	0.9	5
Trichlorofluoromethane	75-69-4		5	0.4	5
1,1-Dichloroethene	75-35-4	330	5	0.7	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	6	5	0.8	5
Carbon Disulfide	75-15-0	2.7	5	0.8	5
Acetone	67-64-1	50	10	4.0	10
Methyl Acetate	79-20-9		5	1.6	5
Methylene Chloride	75-09-2	50	5	0.6	5
trans-1,2-Dichloroethene	156-60-5	190	5	0.5	5
cis-1,2-Dichloroethene	156-59-2		5	0.6	5
Methyl tert-Butyl Ether	1634-04-4	930	5	0.3	5
1,1-Dichloroethane	75-34-3	270	5	0.7	5
2-Butanone	78-93-3	120	10	1.2	10
Chloroform	67-66-3	370	5	0.3	5
1,2-Dichloroethane	107-06-2	20	5	0.5	5
1,1,1-Trichloroethane	71-55-6	680	5	0.3	5
Cyclohexane	110-82-7		5	0.4	5
Carbon Tetrachloride	56-23-5	760	5	1.9	5
Benzene	71-43-2	60	5	0.5	5
Trichloroethene	79-01-6	470	5	0.6	5
Methylcyclohexane	108-87-2		5	0.8	5
1,2-Dichloropropane	78-87-5		5	0.5	5

Bromodichloromethane	75-27-4		5	0.5	5
cis-1,3-Dichloropropene	10061-01-5		5	0.6	5
trans-1,3-Dichloropropene	10061-02-6		5	0.6	5
1,1,2-Trichloroethane	79-00-5		5	0.3	5
Dibromochloromethane	124-48-1		5	0.5	5
4-Methyl-2-Pentanone	108-10-1		10	0.6	10
Toluene	108-88-3	700	5	1.2	5
1,2-Dibromoethane	106-93-4		5	0.4	5
Chlorobenzene	108-90-7	1100	5	0.8	5
Tetrachloroethene	127-18-4	1300	5	0.5	5
2-Hexanone	591-78-6		10	0.5	10
Ethylbenzene	100-41-4	5.5	5	0.6	5
m,p-Xylene	179601-23-1	260 (sum)	5	1.1	5
o-Xylene	95-47-6	260 (sum)	5	0.7	5
Styrene	100-42-5		5	0.7	5
Bromoform	75-25-2		5	0.6	5
Isopropylbenzene	98-82-8		5	0.6	5
1,1,2,2-Tetrachloroethane	79-34-5		5	0.4	5
1,3-Dichlorobenzene	541-73-1	2400	5	1.1	5
1,4-Dichlorobenzene	106-46-7		5	1.2	5
1,2-Dichlorobenzene	95-50-1		5	1.0	5
1,2-Dibromo-3-Chloropropane	96-12-8		5	0.5	5
1,2,4-Trichlorobenzene	120-82-1		5	1.5	5
1,2,3-Trichlorobenzene	87-61-6		5	1.5	5
Bromochloromethane	74-97-5		5	0.6	5

QAPP Worksheet #16
(UFP-QAPP Manual Section 2.8.2)

A project schedule, utilizing Microsoft Project that exhibits the anticipated start and end dates, duration, and major milestones related to the tasks associated with the work assignments will be prepared as the sampling scheduled is finalized. The schedule will be updated throughout the life of the project and tracked by percent complete. It will be the responsibility of the Project Manager to ensure the schedule is kept up to date and revised versions are distributed to the project team in a timely manner. The schedule will aid in determining potential conflicts and provide and accurate look at the progression of the project.

The dates below are approximate and will be determined pending approval of this QAPP.

Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Preparation of QAPP	HDR Project Manager or Project Chemist	August 2009	January 2010	QAPP	01/19/10
Review of QAPP	HDR Project Chemist and QA Manager EPA QA Manager	01/20/10	02/15/10	Approved QAPP	N/A
Preparation of Health and Safety Plan	HDR Project Manager or H&S Coordinator	August 2009	January 2010	HASP	01/22/10
Procurement of Equipment	HDR Project Manager or Field Team Leader	02/15/10	02/19/10	N/A	N/A
Laboratory Request	HDR Project Manager or Project Chemist	02/15/10	02/19/10	Analytical Services Request Form	02/19/10
Field Reconnaissance/Access	HDR Project Manager	02/22/10	02/26/10	N/A	N/A
Collection of Field Samples	HDR Field Team Leader	03/01/10	03/31/10	Daily Quality Control Reports	Each Day of Field Work
Laboratory Package Received	EPA Region 2 DESA/CLP	03/02/10	04/01/10	Unvalidated Data Package	Standard TAT

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Validation of Laboratory Results	EPA Region 2 DESA/CLP	March/April 2010	March/April 2010	Validated Data Package	Standard 35 Day TAT
Data Evaluation/ Preparation of Final Report	HDR Project Manager or Project Chemist	April/May 2010	April/May 2010	Final Report	30 Days after completion of Task 6.2

QAPP Worksheet #17
(UFP-QAPP Section 3.1.1)

Sampling Design and Rationale

Describe and provide strategies and a rationale for choosing the sampling approach: The six (6) monitoring wells will be installed throughout the Site to evaluate groundwater quality and to provide hydrogeologic flow data, particularly in the shallow and semi-confined portions of the upper glacial aquifer above and below the "20 ft clay" unit. The wells will be installed to a maximum depth of 70 ft. Four (4) of the wells (wells to be determined) will be installed with multi-level screens to assess the groundwater at approximately 25 ft and 60 ft at the same location. The remaining two (2) wells will be installed as standard monitoring wells screened just above the deep confining clay layer. Two rounds of groundwater data will be collected from these wells as well as one round of groundwater data from the 20 existing wells to gain a current understanding of site conditions.
Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations/depths (including QC, critical, and background samples), the number of samples to be collected, and the sampling frequency (including seasonal considerations): The purpose of the RI is to determine the full extent of contamination associated with the groundwater plumes identified at the Site. HDR will be collecting soil from the newly installed wells (up to 2 samples at depths to be determined) and groundwater samples from existing (1 round) and newly installed wells (2 rounds) for VOCs. One sample will be collected from each of the existing wells and newly installed wells with the exception of the 4 new wells that will be screened at 2 levels, where one groundwater sample will be collected from each screened interval. (See Worksheet #18) QC samples will be collected for MS/MSD, field blanks, field duplicates, and trip blanks as described in Worksheet #20.
Describe the procedures for collecting samples and identify sampling methods and equipment: Sample collection methods, procedures, and equipment have been outlined in the field SOPs (see Attachment A).

QAPP Worksheet #18
(UFP-QAPP Manual Section 3.1.1)

Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth (ft)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location
Newly Installed Wells (Four of the newly installed wells will be installed with 2 screened intervals, the exact wells will be determined in the field.)*							
SB-24	Soil	TBD	VOCs	Low	Up to 2 (plus DUP)	SOPs #12 and #17	Location is downgradient from the deeper plume. A data gap for deeper groundwater exists here. Proposed location is in the vicinity of Mill Rd Drive-In (dry cleaner).
SB-25	Soil	TBD	VOCs	Low	Up to 2	SOPs #12 and #17	Farther-field downgradient well. The proposed location is west of the furthest east deep detection at HW-222.
SB-26	Soil	TBD	VOCs	Low	Up to 2	SOPs #12 and #17	Located immediately downgradient from the highest concentrations detected in deep groundwater. There is a data gap for deep groundwater in this area (east of Mill Rd.).
SB-27	Soil	TBD	VOCs	Low	Up to 2	SOPs #12 and #17	Location will provide a deep groundwater evaluation at the former Choe's Dry Cleaners (currently Cedarwood Cleaners). There is a data gap for deep groundwater in this area. Also provides a point near the upgradient edge of the plume (along main axis of the plume).
SB-28	Soil	TBD	VOCs	Low	Up to 2	SOPs #12 and #17	Location is near the south boundary of the site and is upgradient of former Choe's Dry Cleaners (currently Cedarwood Cleaners) and along the estimated edge of the shallow plume. There is a data gap for deep groundwater and this point provides an upgradient point for deep groundwater, as well as an upgradient point along the main axis of the plume.
SB-29	Soil	TBD	VOCs	Low	Up to 2	SOPs #12 and #17	General upgradient well for deeper groundwater detections and is along the estimated western edge of the shallow plume.
MW-24*	Groundwater	TBD	VOCs	Trace	1st Round: 2 (plus DUP) 2nd Round: 2 (plus DUP)	SOPs #12 and #17	Location is downgradient from the deeper plume. A data gap for deeper groundwater exists here. Proposed location is in the vicinity of Mill Rd Drive-In (dry cleaner).
MW-25*	Groundwater	TBD	VOCs	Trace	1st Round: 2 2nd Round: 2	SOPs #12 and #17	Farther-field downgradient well. The proposed location is west of the furthest east deep detection at HW-222.

Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth (ft)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location
MW-26*	Groundwater	TBD	VOCs	Trace	1st Round: 2 2nd Round: 2	SOPs #12 and #17	Located immediately downgradient from the highest concentrations detected in deep groundwater. There is a data gap for deep groundwater in this area (east of Mill Rd.).
MW-27*	Groundwater	TBD	VOCs	Trace	1st Round: 2 2nd Round: 2	SOPs #12 and #17	Location will provide a deep groundwater evaluation at the former Choe's Dry Cleaners (currently Cedarwood Cleaners). There is a data gap for deep groundwater in this area. Also provides a point very near the upgradient edge of the plume (along main axis of the plume).
MW-28	Groundwater	TBD	VOCs	Trace	1st Round: 1 2nd Round: 1	SOPs #12 and #17	Location is near the south boundary of the site and is upgradient of fomer Choe's Dry Cleaners (currently Cedarwood Cleaners) and along the estimated edge of the shallow plume. There is a data gap for deep groundwater and this point provides an upgradient point for deep groundwater, as well as an upgradient point along the main axis of the plume.
MW-29	Groundwater	TBD	VOCs	Trace	1st Round: 1 2nd Round: 1	SOPs #12 and #17	General upgradient well for deeper groundwater detections and is along the estimated western edge of the shallow plume.
Existing Wells (only one round of groundwater samples will be conducted for the existing wells)							
MW-10S	Groundwater	Screened Interval	VOCs	Trace	1 (plus DUP)	SOPs #12 and #17	Existing groundwater monitoring wells will be sampled to verify past concentration levels and obtain a current understanding of site conditions.
MW-10D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-11	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-12	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-13S	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-13D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-14	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-15S	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	

Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ ID Number	Matrix	Depth (ft)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location
MW-15D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-16	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-17	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-18S	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-18D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-19	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-20	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-21S	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-21D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-22S	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-22D	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	
MW-23	Groundwater	Screened Interval	VOCs	Trace	1	SOPs #12 and #17	

[1]Specify the appropriate reference letter or number from the Sampling SOP References table (Worksheet #21).

QAPP Worksheet #19
(UFP-QAPP Manual Section 3.1.1)

The following table summarizes DESA's Analytical SOP Requirements. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP SOPs are included in Attachment B.

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Aqueous	TCL Volatiles	Trace	DW-1 (*Ref: EPA 524.2)*	3 X40ml 6 X 40ml (QC)	VOA vial with Teflon-lined septum	Cool, 4ºC ; HCL to pH < 2 $Na_2S_2O_3$, if Res CL present	Preserved w/HCL: 14 days: Unpreserved: 7 days
Soil	TCL Volatiles	Low	C-123 (*Ref:* SOM01.1)	1 x 100g or 4 X Encore Same(QC)	Glass, wide mouth or Encore samplers	Cool, 4ºC or Frozen (-10 to -14)	14 days

QAPP Worksheet #20
(UFP-QAPP Manual Section 3.1.1)

Field Duplicates: Field duplicate samples are analyzed to check for sampling and analytical reproducibility. The general frequency will be one field duplicate for every 20 investigative samples collected (frequency of 5%). Field duplicates will be submitted to the laboratory as "blind" samples (i.e., the actual sampling location will be recorded in the field logbook but not on the chain-of-custody).

Rinsate (Equipment) Blanks: Rinsate (equipment) blanks, or equipment rinsates, are analyzed to check for procedural contamination at the site that may cause sample contamination. Rinsate blanks will be prepared in the field, using laboratory-grade deionized water, by allowing the water to flow over/through the sampling implement and into sample containers with the appropriate preservative. Rinsate blanks will be collected from non-dedicated and non-disposable equipment that are considered ready to collect or process an additional sample. The purpose of this blank is to assess the adequacy of the decontamination process. The general frequency of submittal will be a minimum of 5% or one field blank per day of sampling depending on the size of the project.

Field Blanks: A field blank is used to provide information about contaminants that may be introduced during sample collection, storage, and transport; also a clean sample exposed to sampling conditions, transported to the laboratory, and treated as an environmental sample. The sample will be prepared in the field, using laboratory-grade deionized water, by direct filling sample containers with the appropriate preservatives. The general frequency of submittal will be a minimum of 5% or one field blank per day of sampling depending on the size of the project.

Trip Blanks: Trip blanks are used to assess whether cross-over of constituents between samples occurs during sample shipment and storage. One laboratory-supplied trip blank, consisting of high-grade deionized water (e.g., laboratory "purge" water) will be included along with each shipment of samples to be analyzed for VOCs.

Matrix Spikes/Matrix Spike Duplicates: Matrix spikes provide information about the effect of the sample matrix on the preparation and measurement methodology. One matrix spike will be collected for every 20 investigative samples.

Field QC Sample Summary

Matrix	Analytical Group	Concentration Level	DESA Analytical and Preparation SOP Reference[1]	No. of Sampling Locations	No. of Field Duplicate Pairs	No. of MS/MSD	No. of Trip Blanks (1/ cooler)	No. of Rinsate (Equipment) Blanks	No. of Field Blanks	Total No. of Samples to Lab
Groundwater	VOCs	Trace	DW-1	1st Round: 30 2nd Round: 10	2 1	2 1	6 2	2 1	2 1	44 16
Soil	VOCs	Low	C-123	12	1	1	0	1	1	16

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23). CLP SOPs are included in Attachment B.

QAPP Worksheet #21
(UFP-QAPP Manual Section 3.1.2)

Project field SOPs are listed below and included in Attachment A. HDR will provide sample containers and preservatives for the samples to be collected in accordance with Worksheet #19. All sample containers will comply with OSWER Directive 9240.0-05A: "Specifications & Guidance for Obtaining Contaminant-Free Sample Containers", Dec. 1992 and will be inspected for acceptance prior to sample collection. HDR will follow sample handling and custody procedures outlined in Worksheets #26 and #27.

Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
1	Air Monitoring (Real Time)	HDR	PID/FID, PGM (CGI)	☐	Procedures for calibrating and utilizing air monitoring instrumentation.
5	Decontamination (Drilling Equipment)	HDR	Drilling	☐	Procedures for when, where, and how drilling equipment will be decontaminated.
6A	Decontamination (Non-disposable Chemical Sampling Equipment)	HDR	Re-usable/Non-disposable/Non-dedicated	☐	Procedures for how to decontaminate and store re-usable equipment.
6B	Decontamination (Field Instrumentation – Probes, Water Quality Meters, etc.)	HDR	SWL, YSI, Turbidity, etc.	☐	Procedures for when and how field instruments will be decontaminated.
7	Decontamination (Low Flow Groundwater Sampling Equipment)	HDR	Bladder Pump	☐	Procedures for when and how sampling equpiment will be decontaminated.
8	Deep Subsurface Soil Boring Sampling	HDR	Hollow Stem Auger et al. – Split Spoons	☐	Procedures for installing and logging split spoon samples.
12	EnCore Sampling Procedure for VOCs	HDR	EnCores	☐	Procedures for utilizing EnCore samplers to collect soil VOC samples.
14	Field Parameter Measurement	HDR	YSI, other.	☐	Procedures for collecting field parameter measurements during various water sample collection.
15	Groundwater Level Measurements	HDR	Solinst, other.	☐	Procedures for measuring groundwater and product levels.
16	Groundwater Sampling (Field Parameter Measurement)	HDR	YSI, other.	☐	Procedures for collecting field parameter measurement during low flow groundwater sampling – utilizing a flow through cell.

Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
17	Groundwater Sampling (Low Flow Purge Procedure)	HDR	Bladder Pump, tubing, etc.	☐	Procedures for low flow purging/sampling of monitoring wells and residentail/domestic wells.
18	Hollow Stem Auger Drilling	HDR	Drilling	☐	Proecdures for utilizing hollow stem auger drilling.
19	Mobilization and Demobilization	HDR	All	☐	Procedures for mobilizing/demobilizing personnel, supplies, and equipment.
20	Monitoring Well Completion	HDR	Locking caps, casing, etc.	☐	Procedures for finishing and securing a well.
21	Monitoring Well Development – Pump and Surge Procedure	HDR	Centrifugal pump, Surge block, YSI.	☐	Procedures for well development.
23	Monitoring Well Installation (Cased Overburden Well)	HDR	Drilling, PVC, sand, bentonite	☐	Procedures for well installation.
30	Soil Sample Headspace Field Screening	HDR	Glass jar, foil, PID	☐	Procedures for collecting soil headspace readings.
31	Split-Spoon Subsurface Soil Sampling	HDR	Split Spoons	☐	Procedures for installing and logging split spoon samples.

QAPP Worksheet #22
(UFP-QAPP Manual Section 3.1.2.4)

Field equipment will be examined to check that it is in operating condition and calibrated prior to the start of each day in the field. This includes checking the manufacturers' operating and instruction manual(s) for each instrument to maintain conformance with recommended operation and maintenance and calibration procedures. The instruments will also be calibrated/checked at the end of each day in the field. If abnormal readings are observed throughout the day, either as a result of weather or field conditions, the instruments may be calibrated/checked in order to determine whether any "drift" in the accuracy of the meter's ability to record measurements has occurred. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service. All calibration data will be recorded on field sheets or in the field notebook.

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
MiniRae PID	Calibrate with fresh air or "zero air" to 0 ppm and Isobutylene calibration gas to 100 ppm	Battery pack; sensor module; PID lamp; sampling pump; and inlet connectors and filters (above to be performed by experienced personnel.	Exposure to test/calibration gas (known concentration) to verify the instrument is accurate and hasn't lost sensitivity.	Verify alarm limits, battery charge, and data logging capacity, if using; ensure sample port is clear and instrument is clean	Daily before use; calibration check at the end of each day; and during the day if necessary due to field conditions (dust) or weather (humidity)	0 ppm fresh air; 100 ppm Isobutylene – within ±10% of gas concentration	A spare PID will be available on site. Recalibrate; service as necessary.	Field Team Leader or designee	1, 30
Portable Gas Monitor (e.g., Genesis CGI)	Calibrate with fresh air or "zero air" to 0 ppm and to specified levels required of multi-gas calibration gas	Recharging battery pack; replacing alkaline batteries; Replacing components	Exposure to test/calibration gas (known concentration) to verify the instrument is accurate and hasn't lost sensitivity.	Verify alarm limits, battery charge, pump operation and data logging capacity, if using; ensure sample port is clear and instrument is clean	Daily before use; calibration check at the end of each day; and during the day if necessary due to field conditions (dust) or weather (humidity)	0 ppm fresh air; within ±10% of cal gas concentrations	A spare PGM will be available on site. Recalibrate; service as necessary.	Field Team Leader or designee	1

Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Static Water Level Meter	NA	Replace batteries	Verify the instrument hasn't lost sensitivity	Verify battery charge; ensure the probe is clean and is responding when placed in water; and that the instrument is clean	Daily before use	NA	A spare meter will be available on site. Service as necessary.	Field Team Leader or designee	15
Water Quality Instrumentation	Calibrate with known standards	Replace batteries; maintain/replace sensors; update software	Exposure to test/calibration solutions (known concentration) to verify the instrument is accurate and hasn't lost sensitivity.	Verify battery charge, sensors in tact and data logging capacity, if using; ensure sample port/sensors are clear and instrument is clean	Daily before use; calibration check at the end of each day; and during the day if necessary due to field conditions (e.g. drift)	Within ±10% of cal solutions concentrations	Spare meters will be available on site. Recalibrate; service as necessary.	Field Team Leader or designee	14, 16
Bladder Pump	NA	Verify flow rate through discharge tubing	NA	NA	Prior to operation; continuously during operation	NA	A spare pump will be available on site. Service as necessary	Field Team Leader or designee	17

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

QAPP Worksheet #23
(UFP-QAPP Manual Section 3.2.1)

The following table summarizes DESA's Analytical SOP References. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP SOPs are included in Attachment B.

Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
DW-1	Volatile Organics in Drinking Water by Purge and Trap by GC/MS, Rev 2.0, 3/07	Definite	TCL Volatiles (Trace)	GC-MS	DESA LAB	N
C-123	Analysis of Volatile Organic Compounds by Automated Closed System by Purge and Trap GC/MS, Rev 2.0, 3/07	Definite	TCL Volatiles(Low Soil)	GC-MS	DESA LAB	N

QAPP Worksheet #24
(UFP-QAPP Manual Section 3.2.2)

The following table summarizes DESA's Analytical Instrument Calibration information. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP information is included in Attachment B.

Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC-MS	See SOP C-89	See SOP C-89	See SOP C-89	See SOP C-89	Assigned Lab personnel	SOP C-89

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

QAPP Worksheet #25
(UFP-QAPP Manual Section 3.2.3)

The following table summarizes DESA's Instrument and Equipment Maintenance, Testing and Inspection information. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP information is included in Attachment B.

Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
See list of Instrument given in Worksheet #24	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19	See LQMP, G-10, G-11, G-12, G-19

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23).

QAPP Worksheet #26
(UFP-QAPP Manual Appendix A)

Immediately after collection, samples will be transferred to properly labeled sample containers, and properly preserved. Samples requiring refrigeration for preservation will be promptly transferred to coolers packed with wet ice and/or ice packs. Samples will be shipped on the day of sampling or within an appropriate timeframe as to not exceed the maximum allowable holding time before extraction or analysis. Proper chain-of-custody documentation will be maintained and samples will be analyzed within the specified holding times (See Worksheet #19). Sample custody requirements are outlined in Worksheet #27.

The following table summarizes DESA's Sample Handling information. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP sample handling information is included in Attachment B.

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): HDR Field Team
Sample Packaging (Personnel/Organization): HDR Field Team
Coordination of Shipment (Personnel/Organization): HDR Field Team
Type of Shipment/Carrier: Hand delivery or overnight delivery via FedEx or UPS
SAMPLE RECEIPT AND ANALYSIS (Details in SOP G-25)
Sample Receipt (Personnel/Organization): OSCAR/DESA
Sample Custody and Storage (Personnel/Organization): OSCAR/DESA
Sample Preparation (Personnel/Organization): Lab Personnel/DESA
Sample Determinative Analysis (Personnel/Organization): Lab Personnel/DESA
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Maximum time from sample collection is 48 hours
Sample Extract/Digestate Storage (No. of days from extraction/digestion): up to 60 days
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL (Details in SOP G-6)

Personnel/Organization: DESA Lab
Number of Days from Analysis: 60 days

QAPP Worksheet #27
(UFP-QAPP Manual Section 3.3.3)

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):
Sample handling and custody will be performed according to the CLP Guidance for Field Samplers (EPA-540-R-00-003, June 2001, or updated versions). Forms II Lite will be used for sample custody and sample management documentation in the event that a CLP laboratory is used in lieu of DESA.

Chain-of-custody procedures will be instituted and followed throughout the investigation for samples being analyzed by the laboratory, which will be assigned by the Regional Sample Control Center (RSCC) or Sample Management Office (SMO). These procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The HDR QA Manager must be prepared to produce documentation that traces the samples from the field to the laboratory and through analysis. EPA has defined custody of evidence as follows:

- In actual possession;
- In view after being in physical possession;
- In a locked laboratory; and
- In a secure, restricted area.

The field sampler is personally responsible for the care and custody of the sample until transferred. In the field sampler's bound field logbook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any observations. Entries will be signed and dated, and for any entry that is to be deleted, a single cross out, which is signed and dated, will be applied.

HDR will procure all sample containers and preservatives for the split samples to be collected (see Worksheet #19) as well as shipping coolers, packaging materials and equipment (PPE, PID, etc.) All sample containers will comply with OSWER Directive 9240.0-05A: "Specifications & Guidance for Obtaining Contaminant-Free Sample Containers", Dec. 1992.

Samples will be packaged for shipment in accordance with DOT. Samples will be packaged for shipment in insulated coolers with ice. The ice will be double-bagged in leak-proof plastic bags. Samples, affixed with sample labels, will also be packed in plastic bags. Delivery of the samples to the analytical laboratory will be by hand delivery or by an overnight carrier and the containers will be marked as environmental samples. The coolers will be sealed to prevent leakage. The cooler drain will also be taped shut. Additionally, absorbent pads may be used in packing the empty space inside the cooler to absorb liquids in the event that containers break during transport.

The chain of custody (COC) form will be sealed in a plastic bag and taped to the inside lid of the cooler. A custody seal will be affixed to the outside of the each cooler. It will be placed over the cooler seam, and signed and dated. Nylon reinforced tape will be placed over the seal to reduce the potential for tampering or accidental tearing. The shipping label will be taped to the top of the cooler. All shipping bills will be saved by the Field Team Leader and will become part of the project documentation.

The holding times for the samples packed for shipment must not be exceeded. Therefore, samples will be packed in time to be shipped each day of sampling via overnight delivery to the laboratory or as appropriate as to not exceed maximum holding times. The Field Team Leader will notify the Laboratory Sample Custodian of sample shipment.

To track the shipment of samples from the field to the laboratory, the Field Team Leader will telephone the laboratory following shipment and provide the following information:

- The exact number and types of samples collected and the identification numbers;
- Air carrier and airbill numbers(s);
- Estimated date and time of arrival at the laboratory; and
- Other pertinent information including special handling instructions, changes in scheduled sampling activity, or deviations from established sampling procedures.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal):

At a minimum, the laboratory will identify a Laboratory Project Manager who will be responsible for:Coordinating laboratory analysis;

- Supervising in-house chain-of-custody; and
- Scheduling sample analysis.

The laboratory will also identify a Laboratory QA Officer who will be responsible for overview of the laboratory QA, overview of the QA/QC documentation, and conducting detailed data review. This individual will decide if laboratory corrective actions are required in addition to seeing that laboratory Standard Operating Procedures (SOPs) are followed (See LQMP, SOP G-25 (OSCAR)).

A Laboratory Sample Custodian will be designated who will be responsible for the following tasks:

- Receive and inspect incoming sample containers;
- Record condition of incoming sample containers;
- Sign appropriate documents;
- Verify chain-of-custody and its correctness;
- Notify Laboratory Project Manager of sample receipt and inspection;
- Assign unique identification and customer numbers, and enter each into sample receiving log;
- Initiate transfer of samples to appropriate lab sections; and
- Control and monitor access/storage of samples and extracts.

Primary responsibility for project quality rests with the HDR Project Manager. Independent QA will be provided by the Laboratory QA Officer prior to release of data to HDR. Once this is complete, the unused portion of the sample must be disposed of properly. All identifying stickers, data sheets, and laboratory records are retained as part of the permanent documentation. Sample containers and remaining sample materials are disposed of appropriately.

Chain of Custody:
COC documents providing sample information (sample number, sample ID/location, date/time of collection, number of containers, analysis, preservatives, etc.), signatures, dates and other information as required on the COC form (shipment carrier tracking number, etc.) will be completed by the field sampler for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the COC. Custody of samples must be continuous between parties and time gaps must not be present. The field sampler will sign the COC when relinquishing custody. The original record will accompany the shipment, and a copy will be retained by the field sampler for the project file. The original form will be placed in an airtight plastic bag

in the sample cooler with the associated samples. The field sampling team will ship by commercial carrier the coolers containing environmental samples to the laboratory. The laboratory will assign a number for each sample upon receipt. That sample number will be placed on the sample label. The sample label will remain attached to the sample container.

QAPP Worksheet #28
(UFP-QAPP Manual Section 3.4)

The following table summarizes DESA's QC Sample information. Since it was not known at the time this QAPP was prepared whether DESA or CLP would analyze the samples, the CLP QC sample information is included in Attachment B.

QC Samples Table

Matrix	Aqueous
Analytical Group	VOC
Concentration Level	Trace
Sampling SOP	SOP #17
Analytical Method/ SOP Reference	DW-1 (Ref: EPA 524.2)
Sampler's Name	TBD
Field Sampling Organization	HDR
Analytical Organization	DESA/CLP
No. of Sample Locations	GW 1st round:30, 2nd round 10 and Soil 12

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tuning	12 hr period	Pass all PBFB tune criteria	Check Instrument Reanalyze, Retune	Lab personnel	Sensitivity	Pass all PBFB tune criteria
Initial Calibration	SOP DW-1	% RSD +/- 20% Not more than 10% of total analytes failure	Check Instrument, Reanalyze	Lab personnel	Accuracy/ Precision	% RSD +/- 20% Not more than 10% of total analytes failure

Continuing Calibration Check Standard (Alternate check standard)	1 per analytical batch	Max %D RRF +/- 30% Not more than 10% of total analytes failure	Reanalyze, Qualify data	Lab personnel	Accuracy	Max %D RRF +/- 30% Not more than 10% of total analytes failure
Method Blank	1 per extraction batch	< RL	Investigate source of contamination	Lab personnel	Sensitivity Contamination	< RL
Trip Blank	1 per cooler containing VOC samples	Client Defined	Investigate source of contamination	Lab personnel	Sensitivity Contamination	
LCS/LFB	2 per extraction batch	Limits: Average Recovery 70-130% % RPD < 20	Qualify data unless high recovery and/or Not Detected)	Lab personnel	Accuracy/ Precision	Limits: Average Recovery 70-130% RPD 20%
Laboratory Matrix spikes	1 per extraction batch	Limits 70-130%	Qualify data unless high recovery and/or Not Detected)	Lab personnel	Accuracy	Limits 70-130%
Internal Standards	Each sample, standard, blank	+/- 40% from the initial/continuing calibration	Check Instrument Analyze / Qualify data	Lab personnel	Quantitation	+/- 40% from the initial/continuing calibration
Surrogates	Each sample, standard, blank	Limits 80%-120%	Reinject, Qualify data	Lab personnel	Extraction efficiency, Accuracy	Limits 80%-120%

Matrix	Soil
Analytical Group	VOC
Concentration Level	Low
Sampling SOP	SOP #12
Analytical Method/ SOP Reference	C-123 (Ref: EPA 624)
Sampler's Name	TBD
Field Sampling Organization	HDR
Analytical Organization	DESA/CLP
No. of Sample Locations	12 Total Soil

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Tuning	12 hr period	Pass all PBFB tune criteria	Check Instrument Reanalyze, Retune	Lab personnel	Sensitivity	Pass all PBFB tune criteria
Initial Calibration	SOP C-123	% RSD +/- 50% Min RRF 0.010	Check Instrument, Reanalyze	Lab personnel	Accuracy/ Precision	% RSD +/- 50% Min RRF 0.010
Continuing Calibration Check Standard (Alternate check standard)	1 per analytical batch of 20 samples	Max %D listed in Table 4A of C-123	Reanalyze, Qualify data	Lab personnel	Accuracy	Max %D listed in Table 4A of C-123
Method Blank	1 per extraction batch of 20 samples	< RL	Investigate source of contamination	Lab personnel	Sensitivity Contamination	< RL
Trip Blank	1 per cooler containing VOC samples	Client Defined	Investigate source of contamination	Lab personnel	Sensitivity Contamination	
LCS/LFB	2 per extraction batch of 20 samples	Limits: Average Recovery 70-130% % RPD < 20	Qualify data unless high recovery and/or Not Detected)	Lab personnel	Accuracy/ Precision	Limits: Average Recovery 70-130% % RPD < 20
Laboratory Matrix spikes	1 per extraction batch of 20 samples	Table 8 of C-123 compound specific (full range- 17-259%)	Qualify data unless high recovery and/or Not Detected)	Lab personnel	Accuracy	Table 8 of C-123 compound specific (full range- 17-259%)

Internal Standards	Each sample, standard, blank	Factor of two(-50% to + 100%) from the initial/continuing calibration	Check Instrument Analyze / Qualify data	Lab personnel	Quantitation	Factor of two(-50% to + 100%) from the initial/continuing calibration
Surrogates	Each sample, standard, blank	Table 7 of C-123	Reinject, Qualify data	Lab personnel	Extraction efficiency, Accuracy	Table 7 of C-123

QAPP Worksheet #29
(UFP-QAPP Manual Section 3.5.1)

It will be the responsibility of the Project Manager to ensure the QAPP is current and accurately reflects the work plan and PQOs. The Project Manager will be responsible for updates and distribution of the QAPP. The QAPP shall be maintained electronically within the project file in HDR ProjectWise and hardcopies shall be distributed as per the Distribution List (Worksheet #3).

Field data will be documented in a field logbook or on field data sheets (well sampling and boring logs, etc.) to ensure proper verification of sample results. It will be the responsibility of the Project Manager to ensure that all field staff is documenting field procedures and data as prescribed.

Laboratory analytical data will be documented as defined in the EPA DESA/CLP Statement of Work. For laboratory work outside DESA/CLP, documentation will be equivalent to CLP and specified in the laboratory statement of work. It is not expected that subcontracted laboratories will be needed for this assignment.

Overall project documentation including audit reports, progress reports, and final reports (including Daily Quality Control Audits, Field Quality Control Audits, Field Logs and Notes, and Corrective Action Reports) will be performed according to the approved Contract QMP submitted with HDR's August 2007 SF330 proposal and will be maintained within the project folder on HDR ProjectWise. It will be the responsibility of the Program Manager to ensure that the site-specific Project Managers have read and are aware of the requirements and standards outlined in the QMP and utilize the QMP in execution of the project tasks. Copies of the Field Logs, QC forms and Corrective Action Report are included as Attachments C, D, and E, respectively.

Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
• Field Chains-of-Custody • Packing Slips and Sample Tags • Request Forms and Associated Correspondence • Sample Acceptance Checklist • Daily Quality Control Reports • Field Quality Control Audits • Field Logs and Notes • Photographs		• Internal Chains-of-Custody • Sample Preparation Log • Standard Traceability Record • Instrument Analysis Log • QC summary checklist with all relevant information • Sample Analysis Data • Instrument Calibration Data • Instrument/ Computer Printouts • Definition of Qualifiers • Cover Letter • Approval Form • Case Narrative • Final Report	• Sample acceptance checklist • PT Sample Results • Training Records • MDL Study Records • Initial DOC / CDOC Records • Internal Audit Reports • Corrective Action Reports • External Laboratory Assessment • NELAC Accreditation	• Customer Service Survey Cards • Telephone Logs • Procurement Request Forms • Equipment Maintenance Logs • Validated Computer Software Records

QAPP Worksheet #30
(UFP-QAPP Manual Section 3.5.2.3)

The procurement of analytical services shall follow the EPA Field and Analytical Services Teaming Advisory Committee (FASTAC) process, which requires the use of the following tiered decision tree: 1) DESA laboratory 2) National Analytical Services Contract Laboratories (CLP) 3) Region Specific Analytical Services (SAS) Contract Laboratories 4) Contractor, IAGs, and Field Contractor Subcontract Laboratories. All analytical procurement services shall be coordinated through the Regional Sample Control Coordinator (RSCC).

An Analytical Services Request (ASR) request form for Routine Analytical Services (RAS), standard TCL/TAL analysis, shall be submitted to the RSCC up to one week prior to sampling. The RSCC shall coordinate laboratory information between DESA/CLP and HDR. Analytical service requests will be reviewed for accuracy and completeness and submitted to the DESA lab. In order to process a request, this QAPP must be approved by EPA.

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Aqueous Soil	VOCs	Trace Low	See Worksheet #18	See Worksheet #23	35 Days for Hardcopy	EPA Region 2 DESA 2890 Woodbridge Avenue Edison, NJ 08837 Adly Michael (732) 906-6161	CLP Laboratory TBD

QAPP Worksheet #31
(UFP-QAPP Manual Section 4.1.1)

QA-QC Forms discussed below are included as Attachments D.

The QA team will conduct monthly audits to ensure that all plans and procedures outlined in the QMP have been and will be successfully implemented. HDR's QA/QC program requires QC reviews commensurate with the stage of the project beginning with proposal submittal, scope of work, schedule and budget development. At notice to proceed (NTP), a "zero percent" review will be conducted, proceeded by reviews staged at major project milestones/delivery points. Initial reviews will focus on business issues, client expectations, and resource related elements. Subsequent reviews escalate in detail, including design calculations and analysis (i.e., design checks), scope compliance, inter-disciplinary coordination, drawing projection standards (client and HDR standards), and subcontractor review and coordination. The HDR QA team will be selected by the QA/QC Manager. QA/QC reviewers will be "senior level" engineers, scientists, and/or specialists not involved with the specific project or work assignment. Reviews will be documented on the HDR Management Review Form (MRF).

Field activities performed by both HDR staff and subcontractors will be audited for each phase of work conducted in the field (e.g., well installation and well sampling). The audit will be conducted by the Field Team Leader and will consist of a comprehensive review of field work and health and safety practices to ensure that the procedures employed adhere to the QAPP and SSHP. In general, a field audit will be conducted once per week for each week field activities are occurring. Results of the audit will be summarized on the HDR Field Quality Control Audit (FQCA) form and forwarded to the EPA upon completion. In addition, a Daily Quality Control Report (DQCR) will be completed for each day in the field that will document all activities, visitors, conditions, corrective actions, etc.

EPA Region 2 audits DESA and the CLP laboratories, as necessary, and performs these audits on a program rather than project-specific basis.

A member of the HDR IT team will be assigned to periodically conduct verification of computer models and software to verify correctness, reasonableness, and user competence. The audits will be conducted by entering known data sets or by double entry, cross checking, or range checking. Verification of the models and software performance will be included in the specific reports, as appropriate.

It will be the responsibility of the HDR Project Manager to develop and initiate corrective action as necessary if unacceptable conditions are discovered as a result of the QC audits. The EPA Contracting Officer will be notified if conditions are such that the overall program is affected.

Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
0% Review	Once	Internal	HDR	HDR Project Manager, Program Manager, Project Controller	Department Manager, HDR	Project Manager, HDR	Program Manager/QA Manager, HDR
Management Reviews	Major project milestones	Internal	HDR	HDR Project Manager, Program Manager, Project Controller	Department Manager, HDR	Project Manager, HDR	Program Manager/QA Manager, HDR
Daily Quality Control Report	Once per field day	Internal	HDR	HDR Field Team Leader	Project Manager, HDR	Field Team Leader, HDR	Project Manager/QA Manager, HDR
Field Quality Control Audit	Once per phase of work	Internal	HDR	HDR Field Team Leader	Project Manager, HDR	Field Team Leader	Project Manager/QA Manager, HDR
Internal Audit	Monthly	External	DESA Lab	Lab QA Officer	Lab Personnel	Lab Personnel	Lab QA Officer
PT	Semiannually	External	NELAC	PT provider	Lab Personnel	Lab Personnel	Lab QA Officer
NELAC	Every two years	External	NELAC	Florida DOH	Lab QA Officer	Lab Personnel	Florida DOH

QAPP Worksheet #32
(UFP-QAPP Manual Section 4.1.2)

For non-compliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Project Manager. Implementation of a corrective action will be confirmed through the same channels. Non-conformance with the established QC procedures will be identified and corrected. Non-compliance issues and corrective actions will be reported in a Corrective Action Report. An example is included in Attachment E.

Technical staff and project personnel will be responsible for reporting suspected technical or QA non-conformances, or suspected deficiencies of any activity or issued document, by reporting the situation to the designated Field Team Leader of a particular activity. This individual will be responsible for assessing the suspected problems in consultation with the Project Manager to make a decision based on the potential for the situation to impact the quality of the data. If it is determined that the situation warrants a reportable non-conformance requiring corrective action, appropriate action will be initiated by the Field Team Leader.

The Field Team Leader will be responsible for implementing corrective action for non-conformances that are initiated by:

- Evaluating reported non-conformances;
- Controlling additional work on non-conforming items;
- Determining the action to be taken;
- Maintaining a calendar log of non-conformance events and solutions implemented; and
- Ensuring descriptions of non-conformance and correlating corrective actions are included in the final Site documentation in project files.

If appropriate, the Field Team Leader and Project Manager will not allow additional work that depends on the non-conforming activity to be performed until the corrective actions are completed.

Corrective action for field measurements may include:

- Repeating the measurement to check the error;

- Checking for proper adjustments for ambient conditions such as temperature;
- Checking the batteries;
- Recalibrating instruments;
- Checking the calibration;
- Repairing or replacing the instrument or measurement devices; and
- Stopping work, if necessary, until corrective actions can be implemented and return to appropriate DQOs can be confirmed.
- Corrective actions may also include re-sampling locations, where deemed necessary.

The Field Team Leader or designee is responsible for onsite activities. In this role, the Project Manager, at times, is required to adjust the field programs and procedures to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person will notify the Project Manager or Field Team Leader of the anticipated change and implement the necessary changes after obtaining the approval of the Project Manager. The change in the program will be documented in the field logbook. The Project Manager must approve the change in writing prior to field implementation, if feasible, or else verbally, with written documentation to follow. In addition, the action taken during the period of deviation will be evaluated in order to determine the significance of any departure from established program practices.

The Project Manager is also responsible for the controlling, tracking, and implementation of the identified changes and will regularly inform EPA of any deviations and corrections made.

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
0% Review	0% Review Form	HDR Project Manager, Michael Musso	24 hours of assessment	Investigate and have a corrective action plan for the deficiencies	Program Manager/QA Manager, HDR	2 days from report receipt
Mgmt Review	Mgmt Review Form	HDR Project Manager, Michael Musso	24 hours of assessment	Investigate and have a corrective action plan for the deficiencies	Program Manager/QA Manager, HDR	2 days from report receipt

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Data Impact FQCA	Field Logbook/DQCR FQCA Report	Field Team Leader TBD and HDR Project Manager, Michael Musso	24 hours of assessment	Corrective Action Report	Gloria Sosa, EPA Remedial Project Manager/WAM	2 days from report receipt
Proficiency Testing (PT)	Letter with PT failure indicated	Lab QA Officer	30 days after the audit	Investigate the reason for the PT failure	Lab QA Officer	45 days after the CA report
NELAC	Audit Report with Non-conformance to QAPP, SOPs, NELAC+LQMP	Lab Management	30 days after the audit	Investigate and have a corrective action plan for the deficiencies	Florida DOH	30 days after receiving notification
Internal	Audit Report with Non-conformance to QAPP, SOPs, NELAC Regulations	Lab Management	30 days after the audit	Investigate and have a corrective action plan for the deficiencies	Lab QA Officer	45 days after the CA report

QAPP Worksheet #33
(UFP-QAPP Manual Section 4.2)

The QA Management Report will be prepared at the conclusion of each major phase of the project depending on the size. The report will include a summary of the QA/QC programs and training conducted for the project, conformance of activities to the QAPP, status of project and delays, deviations, results and trends, description of findings, data review activities, implementation of corrective action and effectiveness, data usability assessments, limitation of data use, and data gaps.

Laboratory data will be provided in electronic disk deliverable (EDD) format and data will be managed as per the statement of work and laboratory QA Manual.

Reviews will be performed at the completion of each field activity and summary reports completed at that time. Reviews will be documented on the HDR Quality Control Review Report (QCRR). Final Project Reports must reference the QA Management Report or include a QA/QC section that summarizes the information described above. The report will also address narrative and timeline of project activities, summary of PQO/DQO development, summary of major problems and resolutions, data results summary with tables, figures, diagrams, etc., and conclusions and recommendations.

At the conclusion of field activity, if a CLP laboratory is used, a trip report will be submitted to EPA summarizing the event (samples collected, analysis, QC samples, etc.). An example trip report is included as Attachment F.

Records will be incorporated into the final project files for the samples. The field logs, data packages, and records will be included in the HDR project files, which will be archived for a period of ten years.

The final evidence file will be a central repository for documents that constitute evidence relevant to sampling and analysis activities as described herein. HDR is the custodian of the evidence file and maintains the contents of evidence files for the site including relevant records, logs, field notebooks, pictures, subcontractor reports, and data reviews.

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
QA Mgmt Report	1/At the conclusion of the RI	TBD	HDR Project Manager	HDR Program Manager/HDR QA Manager
QCRR	As needed for each deliverable reviewed	TBD	QC Reviewer	HDR Project Manager/HDR QA Manager
Data Evaluation Report	After all data is validated and assessment is complete	TBD	HDR Project Manager	EPA WAM, EPA Project Chemist, EPA Project Geologist
Trip Report (if necessary)	1/At the conclusion of field activity	TBD	Field Team Leader	EPA WAM, EPA Project Chemist, EPA Project Geologist

QAPP Worksheet #34
(UFP-QAPP Manual Section 5.2.1)

Verification is a completeness check that is performed before the data review process continues in order to determine whether the required information (the complete data package) is available for further review. It involves a review of data inputs, which include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). *Internal* or *external* is in relation to the data generator. Examples of internal and external (DESA) verifications are included in the table below. Information as it pertains to CLP is included in Attachment B.

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Field Logbooks/Notes/Sampling Logs	Field notes will be prepared daily by the Field Team Leader and maintained in the field logbook. Sampling logs will be prepared for each sample location. Field notes and logs will be complete, appropriate, legible, and pertinent. Upon completion of field work, logbooks will be placed in the project files.	I	HDR Project Manager
Chain-of-Custody Record	Review for completeness and accuracy when compared to field logs, laboratory report, and QAPP.	I	HDR Validator
	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. The OSCAR staff supervisor utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan, SOP G-25	E	DESA QA Manager

Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Laboratory Data Package	The procedures for data review : 1- Data reduction/review by Primary Analyst. 2- Review complete data package (raw data) by independent Peer Reviewer 3- The Sample Project Coordinator reviews the project documentation for completeness followed by a QA review by the QAO 4- Final review by Branch Chief/Section Chief prior to release, this review is to ensure completeness and general compliance with the objectives of the project. This final review typically does not include a review of raw data. Details can be found in Laboratory Quality Management Plan.	E	DESA QA Manager
Laboratory Electronic Deliverable	Review for accuracy and completeness when compared to hard copy data package.	E	DESA QA Manager
Laboratory Data Package	Review for completeness when compared to QAPP parameters. Review for completeness when compared to list of QAPP target analytes. Review for frequency of QC samples when compared to QAPP parameters.	I	HDR Validator
Final Sample Report/Data Evaluation Report	Results will be compiled and evaluated in a report for the project. Data will be reviewed against hardcopy results.	I	HDR Project Manager

QAPP Worksheet #35
(UFP-QAPP Manual Section 5.2.2)

Project-specific validation procedures are developed to identify and qualify data that do not meet the measurement performance criteria. Validation inputs include items such as those listed in Table 9 of the UFP-QAPP Manual (Section 5.1). Examples of internal and external (DESA) validation processes are included in the table below. The CLP worksheet is included in Attachment B.

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Validation Parameter	Validation Description	Action	Reviewer/Document
IIa IIb	SOPs	Field Logbooks/Sampling Logs	Review to ensure that sampling methods/procedures outlined in the QAPP were followed and deviations noted/approved. Determine impact of deviations on PQOs.	N/A	HDR Validator
IIa	Custody record	Chain-of-custody record	Review for traceability and custody of samples, sample handling QAPP requirements (delivery/methods used/QC sample frequency)	Apply qualifiers using professional judgment for excursions detected.	DESA Validator / HDR data validation internal review forms
IIa	Custody record	Chain-of-custody record	Chain-of-custody forms will be verified against the sample cooler they represent. Sample Acceptance Checklist is completed. The OSCAR staff supervisor utilizes the analyses request information and the external COC to review the accuracy and completeness of LIMS log-in entries, as reflected on the LIMS Sample Receipt Form Details can be found in Laboratory Quality Management Plan, SOP G-25		OSCAR Personnel DESA LAB
IIa IIb	Laboratory data and custody record	Sample preservation evaluated for representativeness	Review for compliance with preservation methods and procedures outlined in QAPP. Determine impact of excursions on PQOs.	Apply qualifiers using professional judgment for excursions detected and the following approach: Results for samples submitted for organic and inorganic analyses impacted by cooler temperatures of greater than 10°C will be qualified as approximate (UJ, J).	DESA Validator / HDR data validation internal review forms

Step IIa/IIb	Validation Input	Validation Parameter	Validation Description	Action	Reviewer/Document
IIa/IIb	Analytical data package/ Final Report		The procedures for data review: 1- Data reduction/review by Primary Analyst. 2- Review complete data package (raw data) by independent Peer Reviewer 3- The Sample Project Coordinator reviews the project documentation for completeness followed by a QA review by the QAO 4- Final review by Branch Chief/Section Chief prior to release, this review is to ensure completeness and general compliance with the objectives of the project. This final review typically does not include a review of raw data. Details can be found in Laboratory Quality Management Plan.		Primary Analyst, Peer Reviewer, Sample Project Coordinator, Quality Assurance Officer, Section Chief/ Branch Chief. DESA LAB
IIa IIb	Laboratory data	Holding times evaluated for representativeness	Review for excursions from holding time and corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	GC/MS and GC instrument performance evaluated for accuracy/bias	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	Calibration and CRDL evaluated for accuracy/bias	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	Blank analysis evaluated for representativeness	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected.	DESA Validator / HDR data validation internal review forms

Step IIa/IIb	Validation Input	Validation Parameter	Validation Description	Action	Reviewer/Document
IIa IIb	Laboratory data	Organic QC spike results evaluated for accuracy/bias (LCS, MS/MSD, and surrogate recoveries)	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs. .	Apply qualifiers according to validation guidance for excursions detected and using the following approach: If percent recoveries are less than laboratory control limits but greater than 10%, non-detected and detected results are qualified as approximate (UJ, J). If percent recoveries are greater than laboratory control limits, detected results are qualified as approximate (J). If percent recoveries are less than 10%, detected results are qualified as approximate (J) and non-detected results are qualified as rejected (R). Qualification for MS/MSD analyses will be performed only when both MS and MSD percent recoveries are outside of laboratory control limits. Qualification of data will not be performed if MS/MSD or surrogate recoveries are outside of laboratory control limits due to sample dilution. Qualification of data is limited to the un-spiked sample only.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	QC results evaluated for precision (MS/MSD and laboratory duplicate)	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected and using the following approach: If RPDs for MSDs or laboratory duplicates are outside of laboratory control limits, detected results are qualified as approximate (J). For organic analyses, qualification of data associated with MS/MSD excursions will be limited to the un-spiked sample.	DESA Validator / HDR data validation internal review forms

Step IIa/IIb	Validation Input	Validation Parameter	Validation Description	Action	Reviewer/Document
IIa IIb	Laboratory data	Field duplicate results evaluated for precision	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected and using the following approach: If RPDs for field duplicates are outside of laboratory control limits, detected and non-detected results are qualified as approximate (UJ, J). For organic analyses, qualification of data associated with field duplicate excursions will be limited to the field duplicate pair. For inorganic data, qualification is performed for samples of similar matrix, digestion batch, and/or collection date.	DESA Validator / HDR data validation internal review forms
IIb	Laboratory data	Field Duplicates	Compare results of field duplicate analysis with RPD criteria outlined in the QAPP.	N/A	HDR Validator
IIa IIb	Laboratory data	Internal standards evaluated for accuracy/bias	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	Standard tracing evaluated for accuracy/bias	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to professional judgment for excursions.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	Target analyte identification, retention times, quantitation, confirmation, clean-up, and analysis sequence evaluated for representativeness	Review for excursions from corrective action table requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected and using the following approach: Tentatively identified analytes for organic analyses will not be evaluated as part of the validation process.	DESA Validator / HDR data validation internal review forms
IIa IIb	Laboratory data	Reported detection limits evaluated for sensitivity	Review for excursions from detection limit requirements in QAPP Determine impact of excursions on PQOs.	Apply qualifiers according to validation guidance for excursions detected.	DESA Validator / HDR data validation internal review forms

QAPP Worksheet #36
(UFP-QAPP Manual Section 5.2.2)

Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa/IIb	Aqueous Soil	VOCs	Trace Low	See Worksheet #12	Data Validator, DESA And HDR (overall usability and on QA/QC samples)
IIa/IIb	Aqueous Soil	VOCs	Trace Low	Calibration and maintenance logs, Field notes/locations See Worksheets #18 and #22	HDR Field Team Leader/Project Manager

Where CLP analyzes/validates the samples, the Data Validation SOP for trace (aqueous) and low (soil) concentration VOCs under SOW SOM01.2 will be followed.

QAPP Worksheet #37

(UFP-QAPP Manual Section 5.2.3)

Data analyzed by the DESA laboratory and the CLP will be validated using Analytical Method and other EPA requirements. A usability assessment, conducted by HDR, considers whether data meet PQOs as they relate to the decision made, and evaluates whether data are suitable for making that decision. The PARCC (precision, accuracy, representativeness, comparability, and completeness) parameters are a method of assessing the validity and usability of environmental data. Following validation, the HDR project team will assess the data. Assessment will include incorporation of the data validation findings into a database by entering data qualifiers. Assessment will also include review of the quantitative DQOs and the preparation of a summary report. The final RI report will include an evaluation of the overall usability of the data. The quantitative DQOs are defined below.

Precision

If calculated from duplicate measurements:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2) / 2}$$

where,
RPD = relative percent difference
C_1 = larger of the two observed values
C_2 = smaller of the two observed values

Accuracy

For measurements where matrix spikes are used:

$$\%R = 100\% \times \left[\frac{S - U}{C_{sa}} \right]$$

where,
%R = percent recovery

S = measured concentration in spike aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

Completeness
Defined as follows for all measurements:

$$\%C = 100\% \times \left[\frac{V}{T} \right]$$

where,
%C = percent completeness
V = number of measurements judged valid
T = total number of measurements

Comparability
Comparability is the degree of confidence with which results from two or more data sets, or two or more laboratories, may be compared. To achieve comparability, standard environmental methodologies will be employed in the field and in the laboratory, including:

- Using identified standard procedures/methods for both sampling and analysis phases of the project;
- Ensuring traceability of all analytical standards and/or source materials;
- Verifying all calibrations;
- Using standard reporting units and reporting formats, including the reporting of QA/QC data;
- Validating analytical results, including using data qualifiers in all cases where appropriate;
- Requiring that validation qualifiers be provided at all times (e.g., text, tables, figures, etc.) with the associated analytical result; and
- Requiring that any metadata on the data set (i.e., information for purposes of description, administration, technical functionality and requirements, use and usage, and/or preservation) be documented and provided with the data set at all times.

These steps will ensure all future users of either the data or the conclusions drawn from them will have a basis for establishing the acceptance criteria for its use and will be able to judge the comparability of these data and conclusions.

When a definitive off-site laboratory analysis is performed to verify field screening results (e.g., the soil gas survey samples), the comparability between the two sets of results must be established. This evaluation will determine the acceptability of the screening results for use in meeting PQOs and making project decisions. Acceptability will be based on a Percent Different (%D) criterion of 20 percent, calculated using the following equation:

$$\%D = \frac{Vd - Vs}{Vd} \times 100$$

Where, Vd is the definitive value and Vs is the screening method sample concentration value.

For the overall evaluation of comparability, at least 75 percent of the calculated %Ds must meet the 20 percent acceptance criteria.

Representativeness

Representativeness is the degree to which the results of the analyses accurately and precisely represent a characteristic of a population, a process condition, or an environmental condition. In this case, representativeness is the degree to which the data reflect the contaminants present and their concentration magnitudes in the sampled site areas. Sample homogeneity and samping/subsampling variability must be considered during project planning to obtain a higher degree of representativeness. Representativeness of data will be obtained through the proper selection of sampling locations and implementation of approved sampling and analytical procedures. Results from environmental field duplicate sample analyses can be used to assess representativeness, in addition to precision.

Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: • Determine if non-detected and detected sample results are associated with acceptable verification and validation, then the data is usable. • If data that are above action limits are associated with unacceptable verification and validation, determine the impact on the project objectives and develop corrective action, which may include re-sampling and re-running the data point. • If data that are below action limits are associated with unacceptable verification and validation, determine the impact on the project objectives and develop a corrective action which may include use of the data as approximated or re-sampling/re-running the data point.
Describe the evaluative procedures used to assess overall measurement error associated with the project: • Determine if quality control data is within the measurement performance criteria presented in the QAPP during the validation process.
Identify the personnel responsible for performing the usability assessment: • EPA DESA/CLP QA Manager and HDR QA Manager and Project Manager
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: • The usability section of the data validation report.

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

United States Environmental Protection Agency

Peninsula Boulevard Groundwater Plume
Town of Hempstead, Village of Hewlett
Nassau County, New York

Contract No. EP-W-09-009

Work Assignment No. 002-RICO-02TV

January 2010

HDR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

PROJECT SPECIFIC HEALTH AND SAFETY PLAN

For

PENINSULA BOULEVARD – RI/FS
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
PENINSULA BOULEVARD
TOWN OF HEMPSTEAD, VILLAGE OF HEWLETT
NASSAU COUNTY, NEW YORK

Dates in Effect
January 2010 through January 2011

HDR ENGINEERING, INC.
ONE BLUE HILL PLAZA
PEARL RIVER, NY 10965

Project Number 147-112840

Table of Contents

List of Appendices

Attachments

SITE SPECIFIC HEALTH & SAFETY PLAN:
TITLE PAGE
HDR Engineering, Inc.

PROJECT NAME**:** Peninsula Blvd – RI/FS	PROJECT COMPANY:
JOB SITE ADDRESS: Various sampling locations (TBD) in the Village of Hewlett	JOB NUMBER: 147-112840
PROJECT MANAGER: Michael Musso	PHONE NO. : 845-735-8300 x261
SITE CONTACT: N/A	PHONE NO. : N/A

( ) AMENDMENT NO. _____ TO EXISTING APPROVED HASP - DATE EXISTING APPROVED HASP _____

OBJECTIVES OF FIELD WORK:

Install and sample groundwater monitoring wells.

Field Activities Include:
1. Install and sample monitoring wells and sample existing monitoring wells associated with the Site.
2. Collect soil samples from six boreholes.

SITE TYPE: *Check as many as applicable*

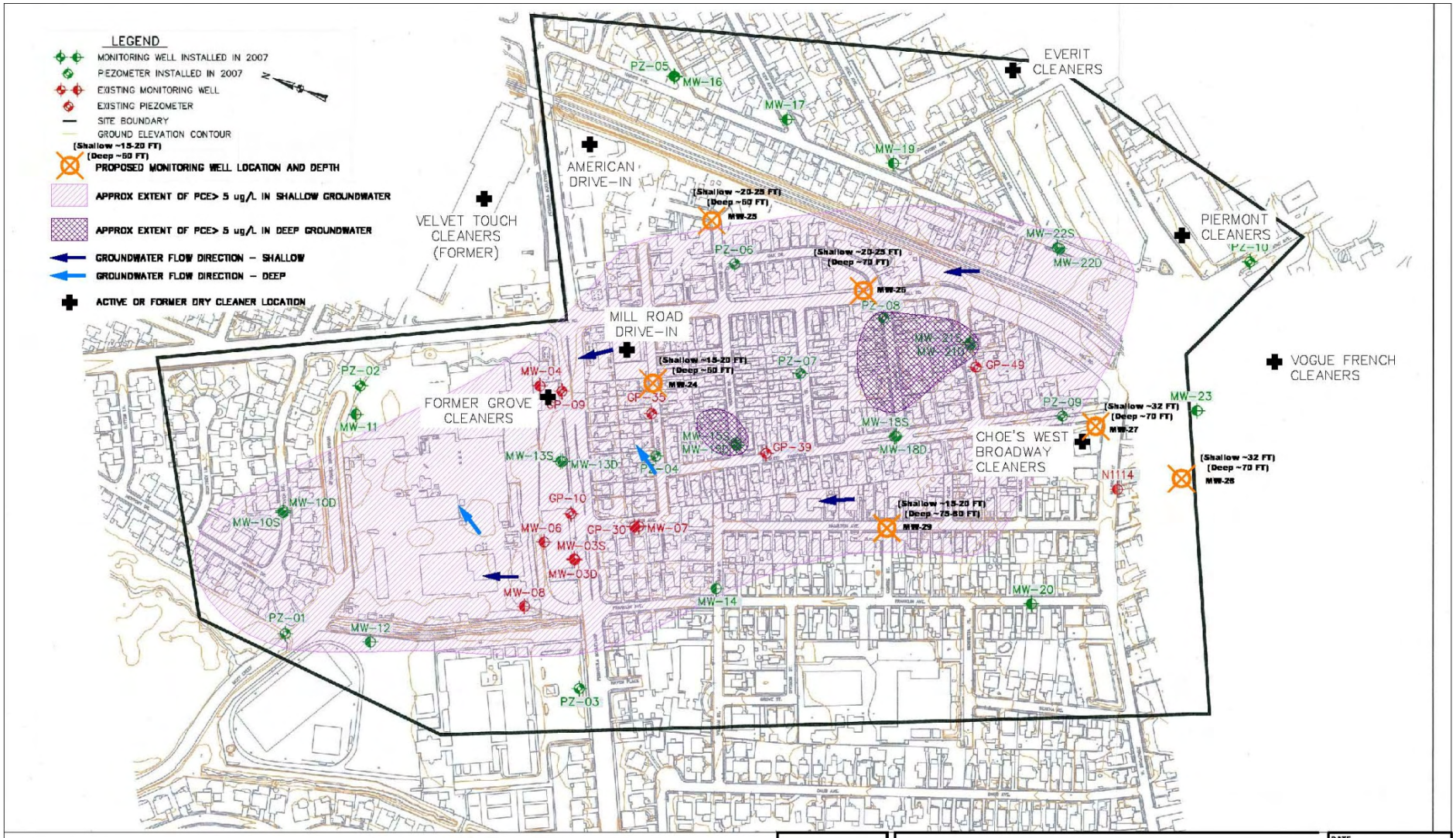
(X) Active	( ) Landfill	( ) Natural
( ) Inactive	( ) Uncontrolled	( ) Military
( ) Secure	( ) Industrial	(X) Other specify**: Well locations (to be determined) in the vicinity of the groundwater plume in the Village of Hewlett – mixed use area; wells may be on public or private property.**
(X) Unsecured	(X) Residential	
( ) Enclosed space	( ) Well Field	

DESCRIPTION AND FEATURES: *Summarize below. Include principal operations and unusual features (containers, buildings, dikes, power lines, hills, slopes, rivers)*

Overhead lines and underground utilities may be present in the vicinity of the proposed well locations. 20 existing locked wells to be sampled.

SURROUNDING POPULATION: (**X**) Residential ( ) Industrial ( ) Rural ( ) Urban (X) Commercial: ( ) Other:

SITE SPECIFIC HEALTH & SAFETY PLAN
SITE LOCATION PLAN / SITE SKETCH
HDR Engineering, Inc.



NOTE: EXISTING PLUME DELINEATION AND WELL/PIEZOMETER LOCATIONS SHOWN ABOVE ARE BASED ON THE DATA EVALUATION REPORT FIGURES 3-3, 6-3, & 6-4 PREPARED BY TETRA TECH EC, INC. FOR THE USEPA

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 inch = 300 ft.

HDR

PROPOSED GROUNDWATER MONITORING WELL LOCATIONS
PENINSULA BOULEVARD GROUNDWATER PLUME

DATE 08-05-09
FIGURE 5

SITE SPECIFIC HEALTH & SAFETY PLAN
EMERGENCY CONTACTS & APPROVAL PAGE
HDR Engineering, Inc.

EMERGENCY CONTACTS			**EMERGENCY CONTACTS**	**NAME**	**PHONE**
EPA Region II		(800) 424-9346	Project Manger	Michael Musso	(845) 735-8300 (ext. 261)
State EPA Office		(212) 637-3000	Health and Safety Officer	John M. Guzewich	(845) 735-8300 (ext. 252)
Site Telephone		N/A	State Spill		1-800-457-7362
Poison Control Center		(800) 522-6337	Fire Department		911
Concentra Health Services (Occupational Health Management)		1-800-229-3674 (ext. 440)	Police Department		911
National Response Center		1-800-424-8802	Number of 24-Hour Ambulance:		911
			Nearest Hospital Emergency Room Number:		(516) 705-2525
			EPA Work Assignment Manager	Gloria Sosa	212-637-4283

1. Evacuation Routes will be specified by the HSO and communicated to all personnel on site.
2. Personnel will evacuate under conditions specified by air monitoring or as directed by the HSO.
3. An INCIDENT REPORT form will be completed for all accidents (see Appendix A).

QA REVIEW: _____ Date:
HDR Office Safety Coordinator

HEALTH AND SAFETY PLAN APPROVALS

Project Manager: _____ Date

Site Health and Safety Officer _____ Date:

Route to Hospital is described on the following page with a map to the hospital on the next page.

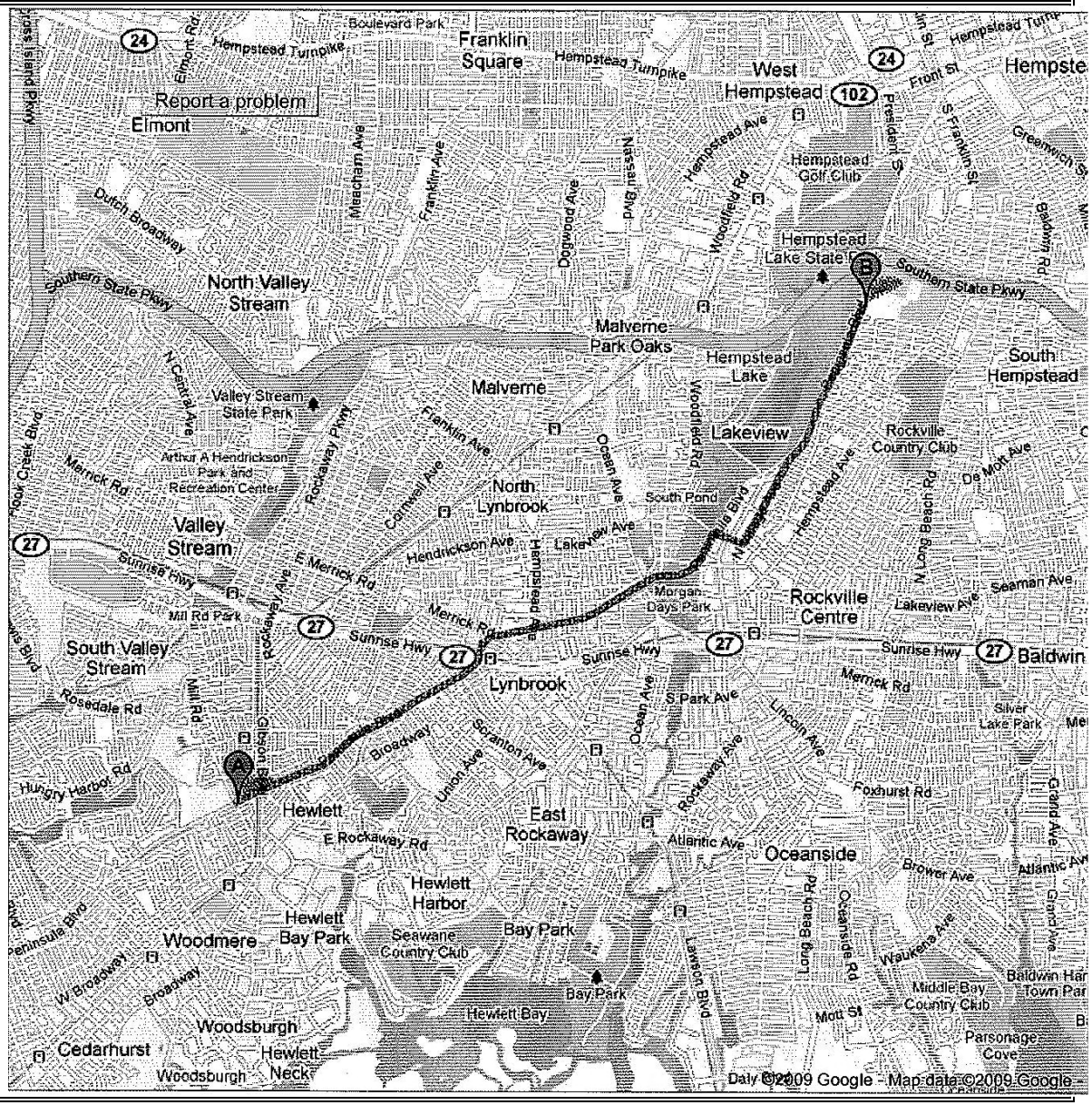
Mercy Medical Center
1000 North Village Avenue
Rockville Centre, NY 11571-9024
(516) 705-2525

SITE SPECIFIC HEALTH & SAFETY PLAN
HOSPITAL MAP ROUTE
HDR Engineering, Inc.

THIS PAGE RESERVED FOR HOSPITAL ROUTE MAP

Directions to Mercy Medical Center from the site:

Head northeast on Peninsula Blvd.
Turn right at Lakeview Avenue.
Take the third left onto North Village Avenue.
Mercy Medical Center is at 1000 North Village Avenue, Rockville, NY,
Hospital on the left.



SITE SPECIFIC HEALTH & SAFETY PLAN
HISTORY AND WASTE CHARACTERIZATION PAGE
HDR Engineering, Inc.

HISTORY: The Peninsula Blvd Groundwater Plume Superfund Site is an area of shallow groundwater contamination with no known source located in Hewlett, NY. Groundwater flow is towards the northwest. Prior sampling has been performed. Additional groundwater sampling and well installations are required as part of the RI/FS. The contaminants of concern in the groundwater are generally chlorinated volatile organic compounds (CVOCs). The soils contain some metals concentrations above typical background concentrations for this area.

WASTE TYPES: ( ) Liquid ( ) Solid ( ) Sludge ( ) Gas ( ) Unknown (X) Other **specify**: soil and groundwater from well installations and sampling

WASTE CHARACTERISTICS: Check as many as applicable.

( ) Corrosive ( ) Flammable ( ) Radioactive

( ) Toxic ( ) Volatile ( ) Reactive

( ) Inert Gas ( ) Unknown (X) Other **specify**: chlorinated solvents may be present

WORK ZONES: Describe how the Exclusion, Contamination Reduction, and Support Zones will be delineated in terms that on-site personnel will recognize.

1. Work zones will be delineated by traffic safety cones

HAZARDS OF CONCERN: Check as many as applicable.

(X) Heat Stress attach guidelines See HDR H&S Pro #28

(X) Noise See HDR H&S Pro #26

(X) Cold Stress attach guidelines See HDR H&S Pro #29

( ) Inorganic Chemicals

( ) Explosive/Flammable

(X) Organic Chemicals

( ) Oxygen Deficient

(X) Motorized Traffic

( ) Radiological

(X) Heavy Machinery

(X) Biological See HDR H&S Pro #34

(X) Slips, Trips & Falls See HDR H&S Pro #3

( ) Other **specify**: CONFINED SPACES WILL NOT BE ENTERED.
(If confined spaces are to be entered a specific confined space entry plan will be developed)

PRINCIPAL DISPOSAL METHODS AND PRACTICES: Summarize Site Specific Conditions Procedures Below:

IDW will be drummed and analyzed for proper disposal procedures.
All non-hazardous waste will be disposed at the staging area for municipal waste pick-up.

SITE SPECIFIC HEALTH & SAFETY PLAN
HAZARDOUS MATERIAL SUMMARY PAGE
HDR Engineering, Inc.

HAZARDOUS MATERIAL SUMMARY: **Underline and bold waste type** and estimate amounts by category (if possible)

CHEMICALS Amounts/Units:	SOLIDS Amounts/Units:	SLUDGES Amounts/Units:	SOLVENTS Amounts/Units:	OILS Amounts/Units:	OTHER Amounts/Units:
Acids	Flyash	Paint	**Halogenated (chloro, bromo) Solvents**	Oily Wastes	Laboratory
Pickling Liquors	Asbestos	Pigments	Hydrocarbons	Gasoline	Pharmaceutical
Caustics	Milling/Mine Tailings	Metal Sludges	Alcohols	Diesel Oil	Hospital
Pesticides	Ferrous Smelter	POTW Sludge	Ketones	Lubricants	Radiological
Dyes/Inks	Non-ferrous Smelter	Aluminum	Esters	PCBs	Municipal
Cyanides	Metals	Distillation Bottoms	Ethers	Polynuclear Aromatics	Construction
Phenols	Other	Other	Other	Other	Munitions
Halogens	Specify:	Specify**:**	Specify:	Specify:	Other
Dioxins			**Specify: See Attached Tables for contaminants of concern identified in prior sampling.**		

OVERALL HAZARD EVALUATION: ( ) High ( ) Medium (X) Low ( ) Unknown (Where tasks have different hazards, evaluate each. Attach additional sheets if necessary)
JUSTIFICATION: Limited exposure to groundwater. PPE to be used.

FIRE/EXPLOSION POTENTIAL: ( ) High ( ) Medium (X) Low ( ) Unknown

BACKGROUND REVIEW: (X) COMPLETE ( ) INCOMPLETE

SITE SPECIFIC HEALTH & SAFETY PLAN
CHEMICAL HAZARD TABLE PAGE
HDR Engineering, Inc.

KNOWN CONTAMINANTS	HIGHEST OBSERVED CONCENTRATION (specify units and media)	PEL/TLV ppm or mg/m^3 **(specify)**	IDLH ppm or mg/m^3 **(specify)**	SYMPTOMS/EFFECTS OF ACUTE EXPOSURE	PHOTOIONIZATION POTENTIAL (eV)
Tetrachloroethene	**53,965 D ug/L GW**	**100/25 ppm**	**150 ppm**	**Irrit eyes, nose, throat, nau, dizz, head**	**9.32**
Trichloroethene	**3,589 D ug/L GW**	**50/100 ppm**	**1,000 ppm**	**Irrit eyes, skin; head, nau, vomit**	**9.45**
1,1,1-Trichloroethane	5.1 J ug/L GW	350/350 ppm	700 ppm	Irrit eyes, nose, dizz, head, CNS depress	11.00
1,1-Dichloroethene	57.9 J ug/L GW	-/5	Ca ND-	Irrit eyes, nose, throat, nau, dizz, head	10.00
1,2-Dichlorobenzene	119 J ug/L GW	50/25 ppm	200 ppm	Irrit eyes, nose; skin blisters	9.06
1,4-Dichlorobenzene	38.5 J ug/L GW	10/75 ppm	150 ppm	Eye irrit, swell periorb, nau, vomit	8.98
1,2-Dichloroethene	1,018 ug/L JD GW	200/200 ppm-	1000 ppm	Eye irrit, resp sys; CNS depress	9.65
Vinyl chloride	8.4 ug/L GW	1/1	Ca ND-	Weak, abdom pain, GI bleeding	9.99
Benzene	150 ug/L GW	1/.01 ppm	500 ppm	Irrit eyes, nose, skin, gidd, head, nau	9.24
Toluene	4.5 J ug/L GW	200/100 ppm	500 ppm	Irrit eyes, nose, weak, dizz, head	8.82
Ethylbenzene	17 J ug/L GW	435/435	800 ppm	Irrit eyes, skin, muc memb, head, derm	8.76
m/p-Xylene	4.8 J ug/L GW	435/435	900 ppm	Irrit eyes, skin, nose, throat, dizz	8.56
Cyclohexane	25 ug/L GW	1050/1050	1300 ppm	Irrit eyes, skin, resp, drow, derm, narco	9.88
Methylcyclohexane	17 J ug/L GW	2000/1600	1200 ppm	Irrit eyes, skin, nose, throat, drow	9.85
Methyl tert-butyl ether	790 ug/L GW	-/40	-		9.24
Bis(2-ethylhexyl)phthalate	5.1 ug/L GW	5/5 mg/m^3	5000 mg/m^3		
Dieldrin	0.039 J ug/L GW	0.25/0.25 mg/m^3	50 mg/m^3	Head, dizz, nau, vomit, sweat	NA
Arsenic	7.2 mg/kg – soils; 12 ug/L GW	0.01/0.01 mg/m^3	5 mg/m^3	Resp rrit, GI disturb, derm, peri meur	N/A
Barium	34 mg/kg - S	0.5/0.5 mg/m^3	50 mg/m^3		N/A
Chromium	14 mg/kg – soils; 71 ug/L GW	1/0.5 mg/m^3	250 mg/m^3	Eye irrit, sens derm	N/A
Lead	44 mg/kg - S	0.05/0.05 mg/m^3	100 mg/m^3	Eye irrit, weak, abd pain	N/A
Mercury	0.099 mg/kg - S	0.025/0.1 mg/m^3	10 mg/m^3	Eye, skin rrit, cough, tremor, chest pain	N/A

NA = Not Available - = None Established U = Unknown
S = Soil SW = Surface Water T = Tailings W = Waste SD = Sediment J - estimated
A = Air GW = Groundwater SL = Sludge D = Drums OFF = Offsite D - dilution

HAZARD COMMUNICATIONS STANDARD

A notebook containing this Site Specific Health and Safety Plan will be taken to the field with the crew and kept in the vehicle. A current inventory of chemicals to be brought on-site and appropriate MSDSs will accompany these chemicals in the vehicle.

SITE SPECIFIC HEALTH & SAFETY PLAN
TASK DESCRIPTION PAGE
HDR Engineering, Inc.

FIELD ACTIVITIES COVERED UNDER THIS PLAN - **ATTACH ACTIVITY HAZARD ANALYSIS FOR EACH TASK**				HAZARD		
TASK DESCRIPTION/SPECIFIC TECHNIQUE-STANDARD OPERATING PROCEDURES/SITE LOCATION(Attach additional sheets as necessary)	Type	Primary	Contingency	SCHEDULE		
1 Mobilization/ Site Preparation	Intrusive	A B C **D**	A B C **D**	Hi	Med	**Low**
	Non-intrusive	Modified	Exit Area			
2 Resample Existing Monitoring Wells	Intrusive	A B C **D**	A B C **D**	Hi	Med	**Low**
	Non-intrusive	Modified	Exit Area			
3 Drill and Installation of the Wells	**Intrusive**	A B C **D**	A B C **D**	Hi	Med	**Low**
	Non-intrusive	Modified	Exit Area			
4 Soil and Ground Water Sampling	Intrusive	A B C **D**	A B C **D**	Hi	Med	**Low**
	Non-intrusive	Modified	Exit Area			
5 Demobilization	Intrusive	A B C **D**	A B C **D**	Hi	Med	**Low**
	Non-intrusive	Modified	Exit Area			
	Intrusive	A B C D	A B C D	Hi	Med	Low
	Non-intrusive	Modified	Exit Area			

PERSONNEL AND RESPONSIBILITIES (Include subcontractors) Responsibilities and the reporting organizational structure are described on the following page.

NAME	PHONE	DATE OF LAST TRAINING	DATE OF HEALTH CLEARANCE	RESPONSIBILITIES	ON-SITE? List task numbers
Michael Musso	845-304-9639	1-29-10		PROJECT MANAGER	Yes, Task 3
John Guzewich	845-548-5493	1-29-10	Feb-09	HEALTH AND SAFETY COORDINATOR	No, Tasks 1-5
Field personnel to be determined				SITE COORDINATOR	Yes, Tasks 1-5
Field personnel to be determined				SITE HEALTH AND SAFETY OFFICER	Yes, Tasks 1-5

SITE SPECIFIC HEALTH & SAFETY PLAN
DESCRIPTION OF RESPONSIBILITIES AND ORGANIZATIONAL STRUCTURE PAGE
HDR Engineering, Inc.

1. Site Safety and Health Personnel.

The Site Health and Safety Officer (HSO), in conjunction with the Site Coordinator, ensures that the provisions of this HASP are adequate and implemented in the field. The Project Manager is to take all necessary actions to guarantee site safety. Changing field conditions may require decisions to be made concerning adequate protection programs and may require deviations or additions to this HASP. All deviations and/or additions must be documented and approved by the HSO on the DEVIATIONS AND ADDITIONS form, located in Appendix B. Personnel assigned as HSO must be experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120 and this HASP. The HSO is also responsible for conducting site inspections on a regular basis in order to ensure the effectiveness of this plan.

2. Organizational Structure and Responsibilities

Briefly describe the responsibilities of all team members and denote the reporting structure.

1. Project Manager
- **a.** Overall responsibility for project schedule;
- **b.** Develop cost estimates for work identified.
- **c.** Identify scope of work and estimate schedule for work;
- **d.** Determine the technical/field team;

2. Site Coordinator (reports to "1" when "1" is on-site, otherwise in charge)
- **a.** Enforce disciplinary action when unsafe acts or practices occur;
- **b.** Grant permission for site access (including visitors, see Appendix C);
- **c.** Designate site security;
- **d.** Enforce the buddy system.
- **e.** Attend all Site pre-entry safety briefings
- **f.** Serve as the facilitator of communications in emergencies

3. Site Health and Safety Officer (HSO) (reports to "2")
- **a.** Maintain daily field log book and a health and safety file for the project;
- **b.** Conduct safety meetings.
- **c.** Monitor on-site hazards and conditions;
- **d.** Enforce safety procedures;
- **e.** Designate facilities, and equipment for health and safety;
- **f.** Select, dispense, and ensure availability of Personal Protective Equipment (PPE);
- **g.** Maintain copies of instrument operation manuals and maintain records of usage and calibration;
- **h.** Periodically inspect PPE and ensure proper storage and maintenance;
- **i.** Monitor for heat and cold stress;
- **j.** Set up decontamination lines, control decontamination, prepare decontamination solutions, and monitor;
- **k.** Train employees on emergency procedures and evacuation routes;
- **l.** Control entry and exit at the Access Control Points;
- **m.** Confirm an employee's suitability for work based on the physician's recommendation.

4. Other On-Site Personnel (report to "2")

SITE SPECIFIC HEALTH & SAFETY PLAN
PPE BY TASK PAGE
HDR Engineering, Inc.

PROTECTIVE EQUIPMENT: Specify by task. Indicate type and/or material as necessary. Use copies of this sheet if needed.

TASKS: **1** - 2 - 3 - 4 - **5** - 6 (X) Primary **(Mob and Demob)**
LEVEL: A - B - C - **D** - Modified ( ) Contingency

Respiratory: (X) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: (X) Not Needed
( ) Safety Glasses:
( ) Face Shield:
( ) Goggles:
( ) Hard Hat:
( ) Other:

Boots: ( ) Not Needed
(X) Boots: Safety-toed work boots
( ) Over boots:
( ) Rubber:

Protective Clothing: (X) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
( ) Tyvek Coverall:
( ) Saranex Coverall:
( ) Cloth Coverall:
( ) Other:

Gloves: (x) Not Needed
( ) Under gloves:
( ) Gloves:
( ) Over gloves:

(X) Other - specify below:
Reflective Vest
(when working near traffic)

TASKS: 1 - **2** - 3 - **4** - 5 - 6 (X) Primary **(Well Sampling & Soil Sampling)**
LEVEL: A - B - C - **D** - Modified ( ) Contingency

Respiratory: (X) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not Needed
(X) Safety Glasses: (if eye hazard exists)
( ) Face Shield:
( ) Goggles:
(X) Hard Hat: (if overhead hazards exist)
( ) Other:

Boots: ( ) Not Needed
(X) Boots: Safety-toed work boots
( ) Over boots:
( ) Rubber:

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
(X) Tyvek Coverall: (Optional)
( ) Saranex Coverall:
(X) Cloth Coverall (Optional):
( ) Other:

Gloves: ( ) Not Needed
( ) Under gloves: Latex
(X) Gloves: (disposable nitrile gloves)
( ) Over gloves: Chemical Resistant (Nitrile)

(X) Other - specify below:
Reflective Vest
(when working near traffic)

TASKS: 1 - 2 - **3** - 4 - 5 -6 (X) Primary **(Well Installation)**
LEVEL: A - B - C - D - Modified ( ) Contingency

Respiratory: ( ) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not Needed
(X) Safety Glasses:
( ) Face Shield:
( ) Goggles:
(X) Hard Hat:
( ) Other:

Boots: ( ) Not Needed
(X) Boots: Safety-toed work boots
( ) Over boots:
( ) Rubber:

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
(X) Tyvek Coverall: (Optional)
( ) Saranex Coverall:
(X) Cloth Coverall:(Optional)
( ) Other:

Gloves: ( ) Not Needed
( ) Under gloves:
( ) Gloves:
( ) Over gloves:

(X) Other - specify below:
Reflective Vest
(when working near traffic)

TASKS: 1 - 2 - 3 - 4 - 5 -6 ( ) Primary
LEVEL: A - B - C - D - Modified ( ) Contingency

Respiratory: ( ) Not Needed
( ) SCBA, Airline:
( ) APR:
( ) Cartridge:
( ) Escape Mask:
( ) Other:

Head and Eye: ( ) Not Needed
( ) Safety Glasses:
( ) Face Shield:
( ) Goggles:
( ) Hard Hat:
( ) Other:

Boots: ( ) Not Needed
( ) Boots: Safety-toed work boots
( ) Over boots:
( ) Rubber:

Protective Clothing: ( ) Not Needed
( ) Encapsulated Suit:
( ) Splash Suit:
( ) Apron
( ) Tyvek Coverall:
( ) Saranex Coverall:
( ) Cloth Coverall:
( ) Other:

Gloves: ( ) Not Needed
( ) Under gloves:
( ) Gloves:
( ) Over gloves:

( ) Other - specify below:

SITE SPECIFIC HEALTH & SAFETY PLAN
AIR MONITORING BY TASK PAGE
HDR Engineering, Inc.

MONITORING EQUIPMENT: Specify by task. Indicate type as necessary. Attach additional sheets as necessary.

INSTRUMENT	TASK	ACTION GUIDELINES	COMMENTS (Includes schedules of use)
Portable Gas Monitor	1 - 2 - **3** - 4 - 5 -___	0-10% LEL No explosion hazard 10-25% LEL Potential explosion hazard; notify HSO. **>25% LEL Explosion hazard; interrupt task/evacuate** 20.9% 02 Oxygen normal <20.5% 02 Oxygen deficient; notify HSO. **<19.5% 02 Interrupt task/evacuate**	( ) Not Needed If % LEL concentration elevated over or at top of borehole, let vent and monitor before continuing boring
Radiation Survey Meter	1 - 2 - 3 - 4 - 5 -___	3X Background Notify SHSC **>2mR/hr Interrupt task/evacuate**	(X) Not Needed
Photo ionization Detector Type MiniRae 2000 ( ) 11.7 ev (or equivalent) (X) 10.6 ev ( ) 9.8 ev ( ) ___ ev	1 - 2 - **3** - 4 - 5 -___	**Specify:** If TOTAL VOC's ≥ 5 PPM above background in the breathing zone, sustained for 5 or more minutes, all personnel shall evacuate the site. Contact Project HSO and the site shall be reevaluated after 30 minutes. The HSO will re-enter the site upwind and monitor with the PID. Once the volatile levels are below 1 PPM, work can continue.	( ) Not Needed
Flame Ionization Detector Type	1 - 2 - 3 - 4 - 5 -___	**Specify:**	(X) Not Needed
Detector Tubes/Monitox Type Type	1 - 2 - 3 - 4 - 5 -___	**Specify:**	(X) Not Needed
Respirable Dust Monitor Type Type	1 - 2 - 3 - 4 - 5 -___	**Specify:**	(x) Not Needed
Other **Specify**	1 - 2 - 3 - 4 - 5 -___	**Specify:**	

Notes:
1. Personal air samples and area samples taken during unique project activities must be documented on the INDUSTRIAL HYGIENE SAMPLING SHEET (see Appendix D).
2. When area samples are collected for routine project activities, the following information must be recorded in the field log book: date and time; location; air temperature; wind direction and speed; cloud cover and type of precipitation; sampler; instrumentation used; activity being sampled; result; sample duration time; applicable comments.

SITE SPECIFIC HEALTH & SAFETY PLAN DECONTAMINATION PAGE HDR Engineering, Inc.		
DECONTAMINATION PROCEDURES		
Personalized Decontamination Summarize below and/or attach diagram; discuss use of work zones. (X) Not Needed	Sampling Equipment Decontamination Summarize below and/or attach diagram; discuss use of work zones. Sampling Equipment decontamination procedures are outlined in the IDW Management Plan. ( ) Not Needed	Heavy Equipment Decontamination Summarize below and/or attach diagram; discuss use of work zones. Heavy Equipment decontamination (drill rig and downhole tools) procedures are outlined in the IDW Management Plan. ( ) Not Needed
Containment and Disposal Method Gloves and disposable clothing will be placed in sealed plastic bags and disposed of as municipal waste.	Containment and Disposal Method Hazardous waste will be transported and disposed by the selected IDW contractor. Non-hazardous waste will be disposed of as municipal waste.	Containment and Disposal Method IDW waste to be sampled by HDR. Drummed waste to be transported and disposed by the selected IDW contractor.

SITE SPECIFIC HEALTH & SAFETY PLAN
WORK ZONE PAGE
HDR Engineering, Inc.

THIS PAGE RESERVED FOR MAP (Show Exclusion, Contamination Reduction, and Support Zones. Indicate evacuation and reassembly points.)

Traffic cones will be used at each location. Locations to be determined. A staging area for heavy equipment decontamination and temporary IDW storage is to be determined, with assistance from the EPA.

During well installation an Exclusion Zone will be established around the drill rig including the area within the shadow of the mast. A Contaminant Reduction Zone will not be required for this project.

SITE SPECIFIC HEALTH & SAFETY PLAN
SIGNATURE PAGE
HDR Engineering, Inc.

The following personnel have read and fully understand the contents of this Site Health and Safety Plan and referenced HDR H&S procedures and further agree to all requirements contained herein. Furthermore, the individuals are fully trained and have required clearances in accordance with HDR H&S Procedure #20. Attach copies of current HTRW and first aid training, medical clearance, and respiratory fit test records.

Name	Affiliation	Date	Signature

Appendix A
Accident Reporting

All accidents, injuries and illnesses which occur from performing project activities in this HASP require that the injured person and the Site Health and Safety Officer complete an INCIDENT REPORT and forward it to the Corporate Director of Safety, Mr. Jim Woolcott, in Omaha, Nebraska.

Incident Report

HDR Engineering, Inc.
8404 Indian Hills Drive
Omaha, NE 68114-4049
(402) 399-1000

Project Name:	Incident Location:
Project No.:	Date/Time of Incident:
Project Manager/ employee supervisor:	Reported to Omaha, Date/Time/to Whom:

Person(s) affected:

Name:	Phone:

Witnesses:

Name:	Phone:

Health Care Treatment Facility Used:

Name:	Address:	Phone:

Treating Physician/Health Care Provider:

Name:	Phone:

Person(s) Treated:

Name:	Extent of Injuries:

Describe the Incident, the project activity being performed, and just how the incident occured (please be descriptive, use proper names, etc.):

Continued on Reverse

Specific recommendations, to prevent this incident from reoccuring:

Comments:

Reported by | Date of Report | Phone

For Use by Health and Safety Manager:

Number of Sheets Attached:

Forwarded:

Appendix B
Deviations and Additions Form

Deviations from and additions to this HASP are permitted and sometimes required based on additional information obtained since the preparation date of the HASP. The DEVIATIONS AND ADDITIONS form will be used to authorize and record all deviations and additions that occur after any one individual has signed this document. Changes in this HASP are only permitted with the following:

1. Written documentation of what the deviation or addition is and reference to the appropriate section from this HASP;
2. Written justification for the change;
3. Verbal communication of the change to all personnel who are directly affected and answering all questions regarding the change to the satisfaction of those same individuals; and
4. Signatures from all personnel who are affected by the change prior to commencing project activities on site with an approval signature from the Site Health and Safety Officer.

Health and Safety Plan Deviations and Additions

HDR Engineering, Inc.
8404 Indian Hills Drive
Omaha, NE 68114-4049
(402) 399-1000

Change 1: Section:

Description of Change:

Justification:

Safety Impact:

Signatures of Acknowledgement:

Resident Field Representative	Date		Date
	Date		Date
	Date		Date

Change 2: Section:

Description of Change:

Justification:

Safety Impact:

Signatures of Acknowledgement:

Resident Field Representative	Date		Date
	Date		Date
	Date		Date

Appendix C
Visitors Log

Visitors to the site may be permitted entrance into the exclusion and contamination reduction zones based upon approval of the Site Coordinator. Otherwise, they must remain in the support zone. The Site Coordinator will be responsible for documenting the name and identity of all visitors in the VISITORS LOG.

VISITORS LOG

Name	Company or Agency	Purpose of Visit	Area(s) to be entered	Date and Time on Site	Checked in by:

Appendix D
Industrial Hygiene Sampling Sheet

Personal air samples and area samples taken during the performance of unique project activities must be documented on the INDUSTIRAL HYGIENE SAMPLING SHEET. A unique project activity is defined as any activity that requires special health and safety training over and above that required in 29 CFR 1910.120. This includes handling drums; climbing, entering or working near confined spaces; entering excavated trenches or pits; walking or climbing on elevated platforms, walkways or ladders; and those project activities involving unmanned heavy machinery or industrial power equipment.

AIR MONITORING AND SAMPLING FORM

Project Name: _____ **Project Number:** _____

Type of Sample: Personal/Area

Location		Date	
Employee/Area		Sampler #	
SSN#		Job Title	
Area			
Operation Monitored			

Personal Protective Equipment:

Eye Protection		Clothing	
Respirator		Other	
Gloves/Boots		Other	

Pump Number: _____

Start Calibration		Sample Start Time	
End Calibration		Sample End Time	
Sample Badge #		Sample Duration	
Manufacturer		Sample Volume	

Remarks (i.e., possible interference, weather conditions, level of exertion, etc.)

_____

Samples Collected By:	
Analysis Requested	
Sampling Method	
Laboratory	
Sample Results	
Collection Media	

TABLE 1
Physical Hazards

Hazard	Sources	Pre Planning to Control Hazard	Active Control Measures
Ergonomics	Lifting and Bending	• Buddy System	• Proper lifting and bending • If lift > 60 lbs, use buddy • Use mechanical aid if possible (e.g. hand truck, wheelbarrow)
Topography	Uneven terrain/debris	• Review site prior to layout. Identify areas unsafe for employees and equipment. • Identify/locate existing utilities. • Determine impact of site operations on surrounding properties, communities, etc. • Identify mechanized equipment routes both on site and onto and off the site. • Layout site into exclusion and contamination reduction zones based on initial site evaluation. • Keep area organized; beware of slips, trips and falls	• Awareness to work environment regular inspection/audits to identify changing conditions. • Shut down operations when unknown conditions encountered.
Fires & Explosions		• Evaluate all operations for fire and explosion potential. • Define specific procedures for unique operations presenting unusual hazard such as flammable tank demolition. • Ensure that proper employees are trained. • Define requirements for handling and storage of flammable liquids on-site, need for hot work permits and procedures to follow in the event of fire or explosion. • Define the type and quantity of fire suppression equipment needed on site. • Coordinate which local fire fighting agencies when required.	• Inspect fire suppression equipment on a regular basis. • Store flammables away from oxidizers and corrosives. • Utilize Hot Work Permit for all hot work onsite. • Follow any site-specific procedures regarding work around flammables. • Review and practice contingency plans. Discuss on regular basis at scheduled safety meetings.

Hazard	Sources	Pre Planning to Control Hazard	Active Control Measures
Heat Stress	Weather Conditions Confined Spaces	• Anticipate elevated temperatures. • Utilize lightweight/light-colored clothing.	• Provide cool break area. • Implement medical monitoring if necessary • Provide cool drinks (i.e. Water or Gatorade). • Buddy system/awareness. • First aid on site. • Medical care if symptoms persist.
Heavy Equipment Operation	Drill Rig/Loader/Trucks Equipment backing up and striking people, objects, or aboveground utility lines Personnel in area of a suspended load or overhead moving equipment	• Define equipment routes and traffic patterns. • Insure that operators are properly trained on equipment operation. • Define safety equipment requirements, including back up alarm and roll over, for all equipment. • Require operators to safely inspect equipment on a daily basis in accordance with manufacturer requirements. • Evaluate project requirements to ensure that equipment of adequate capacity.	• Equipment inspections are performed. Equipment repaired or taken out of service. • Ground spotters are assigned to work with equipment operators. Utilize standard hand signals and communication protocols. • Employees wear the proper PPE; utilize hearing protection, gloves for handling rigging, etc. • Equipment safety procedures discussed at daily scheduled safety meetings. • Employees do not exceed lifting capacities, load limits, etc. for equipment in question. • Prohibit passengers on equipment, activating brakes and grounding buckets, securing loads prior to movement, etc.
Noise	Drill Rig/Loader/Trucks	• Local community noise standards examined. • Expected loud operations evaluated to determine compliance with community standards. • Noise level standards established for equipment. • Hearing protection requirements defined for employees expected to have excessive exposures. • Wear proper hearing protection	• Implement institutional and/or engineering controls when possible (e.g. sound barriers, mufflers/silencers • Employees are required to wear hearing protection when noise levels exceed 85 dB. • Employees in Hearing Conservation Program receive annual audiogram. • Routine noise level monitoring and dosimetry performed as required for assessment. • Defective equipment repaired/replaced as needed.
Personal Injuries	Punctures – Sharp Objects Slip, Trip, & Fall	• Site operations will be evaluated for exposures with serious injury potential such as falling objects, pinch points, flying objects, falls from elevated surfaces, etc. • PPE requirements will be based on potential for injury. • Be certain of footing and keep work areas free of obstructions • Mark holes/ditches	• Employees will wear required PPE. • Report all injuries and near miss incidents to the HSO. • A first aid / CPR trained person on site at all times. • All injuries will be assessed and treated on-site when possible. Professional medical assistance will be summoned (911) for all serious injuries.

Hazard	Sources	Pre Planning to Control Hazard	Active Control Measures
Contaminated Media Exposure	Contaminated soil and/or groundwater	• Prepare HASP • Ensure that employees are properly trained • Ensure employees are aware of symptoms of over-exposure to the potential contaminants of concern	• Wear appropriate PPE • Minimize handling. • Screen wells headspace/soil samples with PID immediately. • Place soil cores in closed drums as soon as possible.
Weather Conditions	Natural Environment	• Evaluate prevailing weather conditions for the site. • Contingency plans developed for likely severe weather conditions such as tornado, and extreme thunderstorm. • Provide for daily weather forecast service in extreme weather areas. • Plan to weatherize safety systems, such as showers and eye washes that would be impacted by extreme cold weather. • Order necessary specialized cold weather clothing. • Grounding and bonding requirements defined for thunderstorm areas. • Sheltered air-conditioned break areas provided for extreme hot and cold weather zones.	• Employees trained in contingency plan for severe weather conditions. • Emergency water sources inspected regularly in cold weather. • Weather service contacted regularly during storm conditions. • Employees should cease outdoor operations during extreme storm conditions (i.e., thunderstorms). Employees evacuate to safe assembly area.
Biological Hazards	Insects/Ticks Dogs/Snakes/Poison Ivy	• Inspect work environment where tasks are being performed. • Awareness to snake bites. Avoid but do not kill snakes! • Be aware of and do daily inspections (especially for ticks on clothing or skin) • Remove food refuse daily • Avoid contact • Determine if any of crew have any severe allergic reactions to bee or wasp stings (if so they should carry their medicine with them (e.g epinephrine pen)	• Provide first aid on site. • If site is heavy with poison Ivy, issue barrier cream and instruct in use. • Don't call/pet feral animals • If wasp/hornet nest is in work area, spray to kill from a safe distance - wear PPE. • Seek medical attention if symptoms-signs persist.

1.0 OBJECTIVE

Each year, physical injuries due to common slips, trips and falls from the same level surface account for a significant percentage of all reportable accidents in the USA. Most of these accidents are preventable through proper housekeeping, correct walking surfaces and proper precautions. It is the objective of HDR to prevent injuries or "near misses" occurring from slip, trip, or fall hazards by the identification, elimination and/or control of these hazardous conditions.

2.0 PURPOSE

This procedure describes work practices that will reduce or eliminate slips, trips, and falls and thereby reduce or prevent the injuries associated with these types of accidents. The intent is to prevent injuries, maintain a safe workplace and a healthy workforce.

3.0 APPLICABILITY

The HDR Slip, Trip and Fall Prevention Program implemented in this Procedure applies to all HDR personnel at HDR client sites and at all HDR facilities working on horizontal surfaces. All employees, regardless of HDR Department, will be impacted by this program. Fall hazards due to climbing or working on elevated surfaces are addressed in the following HDR H&S Procedures: #12 – *Fall Protection*, and #2 – *Portable Ladders*.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this Procedure to their respective office staff, and make sure that this procedure is readily available in each office, and

- Interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation.

5.0 REQUIREMENTS

The following requirements detail a number of rules and methods to prevent slips, trips, and falls. These requirements shall be implemented at all HDR offices where we control the physical environment. Employees should also be alert for these hazards at project sites, where the hazardous conditions are not usually created by HDR, nor even under our control. HDR employees at these sites should look for, and avoid, these potential hazards to prevent suffering an injury.

5.1 **General Housekeeping**. Personnel shall keep the working area clean and orderly. Tools must not be left lying on floors, walkways or decking where they present tripping hazards.

5.2 **Debris**. Small, loose items such as pop cans, rope, trash or other small objects and debris shall not be left lying around in any place, particularly in areas where personnel walk.

5.3 **Walkways and Grating**. Walkways and grating must be kept free of obstacles that could cause trips. Openings in walkways and grating are very hazardous and should never be left unattended – either close, repair or cover before leaving them. If not immediately repaired, the openings must be roped or barricaded off until corrected. Also be alert for raised portions of walkway surfaces, such as sidewalk section edges, which create trip hazards. If necessary, bank the raised portion with wood or sandbag to cover the abrupt raised edge and provide a gradual transition to the upper walkway surface.

5.4 **Access Points**. Access points or holes in gratings must be covered or surrounded by an adequate guard rail.

5.5 **Spills**. Oil spills, water (including ice cubes in break areas) and spills of other slippery materials must be cleaned up immediately. Tracking through even a small spill will significantly reduce the friction coefficient between your shoes and any hard floor material, making a slip more likely. Not only are oil spills a slip hazard, but combustible oils also present a fire hazard.

5.6 **Steel Decks**. Personnel shall take extra precautions when walking on steel decking or catwalks during wet weather, such as establishing firm hand holds, wearing suitable footwear, and walking slowly. If possible, spread sand across the flooring to increase traction.

5.7 **Jumping**. Personnel shall not jump from elevated places or the backs of trucks or equipment. Employees should also refrain from jumping laterally across any excavation, even a shallow one. If excessive width prevents a normal stepping motion, find another route of access.

5.8 **Tools**. Personnel using hand and mechanical tools must position themselves properly to avoid slipping, considering required leverage as well as anticipating likely consequences if the tool suddenly moves or gives way. This pre-planning becomes even more critical when working at heights.

5.9 **Climbing Surfaces**. Personnel shall not walk or climb on piping, valves, fittings, diagonal cross-bracing or any other equipment not designed as walking or climbing surfaces. When ascending ladders or fixed vertical stairs, do not carry tools, notebooks, etc. by hand – this is dangerous! Pre-plan prior to site arrival, and either place these items in a backpack/fanny pack, or else ascend to the upper working surface and then hoist them by means of a rope and bucket.

5.10 **Stairways, Walkovers, and Ramps**. Stairways, walkovers or ramps shall be installed where personnel must walk or step over equipment in the course of their normal duties. In client facilities where these crossovers exist, use them! In our office buildings, it is particularly important to keep stairways and landings clear of any obstacles. DO NOT USE STAIRWAYS OR LANDINGS AS STORAGE AREAS!

5.11 **Extension Cords**. Electrical extension cords and electrical wiring must be kept clear of walking and working areas and/or covered, elevated, buried or otherwise secured. Exposure to loose extension cords is one of the most common causes of trips in the office environment. (By definition, an extension cord is for temporary power only; it is not to be used as a substitute for permanent wiring.) If an extension cord must be left across a walkway, tape it in place or cover it with a non-conductive (e.g., rubberized) mat to prevent dislodgment.

5.12 **Winter Conditions**. Walking and working surfaces must be properly maintained during inclement winter weather. Ice on sidewalks/parking lots account for many falls. Either physically remove the ice, or apply a chemical de-icer to traveled pathways to remove the ice. As an immediate (but less effective) alternative, sand or cinders may be thrown over the ice to improve traction. Hard-packed snow can also reduce the traction of walkers and should be removed by physical or chemical means. **Never walk on any elevated surface (scaffold, outside fixed stairway, ladder) when ice is present**!

5.13 **Running**. Running is prohibited on job sites unless under emergency conditions.

5.14 **Lunch Areas**. Lunch areas should be kept clear of empty bottles, containers and papers. Trash receptacles should be provided and used.

5.15 **Lighting**. Adequate lighting allows employees to see potential obstructions and prevents many falls. Make sure that all halls, passageways and stairs have adequate illumination; replace all burned out bulbs or defective receptacles.

5.16 **Elevated Work Platforms**. When working on scaffolds, stairwells, unfinished floors or any area presenting restricted body movement, place all tools to one side/corner of the area to prevent stepping on or kicking them during site activities.

5.17 **Windy Conditions**. Be aware of the hazards when working in high winds. Sudden gusts can cause a loss of balance, or blow tools, papers, hardhats, etc., causing a distraction and corresponding quick body movement that could result in falls. When preparing for site activities in windy conditions, secure hardhats with chin straps and use notebooks that will hold papers securely, eliminating the distraction caused by flapping papers. Also, preplan each body movement, anticipating sudden gusts and their effects on your body.

6.0 FALL PROTECTION

Fall hazards of 4 feet or more should be evaluated to determine what fall preventative steps might be implemented. Fall protection is required at heights of 6 feet or greater. This rule also applies if walking/stepping across an excavation 6 feet or deeper. Reference HDR H&S Pro #12 – *Fall Protection*, for more information.

1.0 OBJECTIVE

Many operations and equipment encountered at project sites produce noise. Exposure to prolonged excessive levels of noise can result in a permanent loss of hearing acuity, development of tinnitus (i.e., ringing of the ears), a possible increase in blood pressure, and stress-related problems. Noise may also cause difficulty in communicating or working effectively and safely. It is the objective of HDR to provide proper training, protective equipment, and (if necessary) audiometric monitoring to prevent permanent and temporary occupational hearing loss resulting from noise exposure.

2.0 PURPOSE

The purpose of this information is to assist HDR employees in recognizing and avoiding noise hazards encountered at project work sites, thereby preventing hearing loss due to workplace noise exposures. It is the goal of this HDR Noise program to prevent employees from being subjected to noise exposures in excess of 85 dBA, as a daily, time-weighted average.

3.0 APPLICABILITY

This Procedure applies to occupational exposure to noise hazards and applies to all HDR personnel at HDR client sites and at HDR facilities. Depending on assigned tasks, all employees, regardless of HDR Department, may be impacted by this program. The standards set forth in this procedure for preventing hearing loss are based on OSHA 29 CFR 1910.95, 29 CFR 1926.52 and the Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH).

4.0 PROGRAM IMPLEMENTATION

This plan will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC) and project-specific Site Health and Safety Officer.

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators (OSCs) and Site Health and Safety Officers (HSOs). The OSCs and HSOs shall:

- Provide initial training on this Procedure to their respective office staff, and make sure that this procedure is readily available in each office;
- Interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation;
- Assist employees exposed to noise levels that exceed the Action Limit to become enrolled in the HDR Hearing Conservation Program, as outlined in this Procedure, and
- Enforce the use of hearing protectors where required.

5.0 DEFINITIONS

Action Level - A routine daily exposure to an 8-hour time-weighted average noise level in excess of 85 decibels, when measured with a dosimeter or sound-level meter on the A-scale at slow response. The action level is the criterion for instituting employee participation in the Hearing Conservation Program, which includes audiometric testing.

Administrative Control - Any procedure that limits the noise dose by limiting the time or intensity of exposure, such as changes in the work schedule, increasing the distance between the noise source and the worker, or reducing exposure time through job rotation.

Audiogram - Charts, graphs or tables that result from an audiometric test. An audiogram shows an individual's hearing threshold level as a function of frequency (Hz). The HDR Hearing Conservation Program consists of a baseline, or initial audiogram, and annual audiograms thereafter. Annual audiograms detect shifts in an individual's threshold of hearing by comparison to their baseline audiogram.

Decibel (dB) - A unit of measurement of sound-pressure level. The decibel level of a sound is related to the logarithm of the ratio of sound pressure to a reference pressure. The dB has meaning only when the reference is known. The internationally accepted reference pressure is 20 micropascals.

Decibels, A-Weighted (dBA) - A sound level reading in decibels made on the A- weighted network of a sound-level meter at slow response. The "A" scale mimics the auditory response of the human ear.

Decibels, Peak (dBP) - A unit used to express peak sound-pressure level of impact noise.

Engineering Control - Any mechanical device, barrier, enclosure, or other design procedure that permanently reduces the sound level at the source of noise generation, or along the path of travel.

Hertz (Hz) - A unit of measurement of frequency; equal to cycles per second.

Impact Noise - Variations in noise levels that involve peaks of intensity that occur at intervals greater than one second. If the noise peaks occur at intervals of one second or less, the noise is considered *continuous*.

Common project impact noises occur during drill rig auger hammering, hammer forge operations, sheet pile installation, etc.

"Loudness" – An individual's perception of the intensity of sound pressure level. Arbitrary and without scientific meaning.

Noise - Unwanted sound. Considered a physical contaminant.

Noise Dose - A measure of cumulative noise exposure over a stated period, which takes into account both the intensity of the sound and the duration of the exposure.

Noise Dosimeter - An electronic instrument that integrates cumulative noise exposure over time and yields a noise dose, expressed as a time-weighted average in decibels.

Noise Hazard Area - Any work area with a continuous noise level of 85 dBA or greater.

Representative Exposure - The measurements of an employee's noise dose, which is representative of the exposure of an employee in a work area or job classification.

Standard Threshold Shift (STS) - An average hearing threshold shift of 10 dB or more at 2000, 3000, and 4000 Hz in either ear. A threshold shift can be temporary or permanent. *Temporary threshold shift* is a change in hearing threshold, primarily due to exposure to short-term, high-intensity noise, that is usually recovered in 14 to 72 hours after exposure ceases. Any loss that remains after an adequate recovery period is termed *permanent threshold shift*.

Sound-pressure level - The term used to identify the intensity of sound (expressed in decibels), commonly perceived as "loudness."

Sound-level meter (SLM) - An electronic, hand-held portable instrument used to measure sound pressure levels, conforming to the requirements for a Type II sound-level meter as specified in ANSI S1.4-1983. Battery powered, SLMs are used for area surveys, and to determine the sound pressure levels generated by specific point-source machines or processes. Yields instantaneous sound pressure readings; does not give time-weighted averages.

Time-Weighted Average (TWA) Sound Level - The accumulated, average sound level over a defined period, usually 8 hours. Thus it is normally referred to as an "8 hr TWA". OSHA standards for maximum permissible noise exposures are given in 8 hr TWA decibels. **OSHA requires that HDR employees exposed to an average, daily noise level of > 85 dBA (8 hr TWA) wear ear protection, and participate in our Hearing Conservation Program**. TWA integrated values are measured with a noise dosimeter.

6.0 CHARACTERISTICS OF SOUND

Sound is generated by the reception of airborne pressure waves caused by any vibrating source. The ear receives this mechanical energy, and transforms it to electrochemical impulses that are transmitted to the brain, resulting in the perception of sound. When exposed to high pressure levels for long periods of time, the receiving transmitters in the inner ear become deadened, resulting in a permanent reduction of hearing ability. **The intensity of sound pressure levels varies inversely with distance, so moving a short distance away from a source can greatly reduce the dose**.

7.0 REGULATORY NOISE LIMITS

7.1 Eight-hour, Time-weighted Average Exposure Limits.

The OSHA action level for an 8-hour, time-weighted average exposure is 85 decibels (dB) of sound pressure measured on the A-weighted scale (dBA). This means that if an employee's daily noise exposure level, averaged over 8 hours, exceeds 85 dBA, then they must be enrolled in a hearing conservation program, and must be provided hearing protection. For single exposures of shorter or longer duration, the exposure limit must be adjusted.

Since the functions of our project staff generally afford them the option of moving freely about the project site, there is no reason for HDR employees to ever be exposed to excessively loud noises for extended periods of time (one exception is when operating boats or motorized specialty vehicles, where we are required to remain at the point of noise generation). If a nearby process generates high noise levels, our employees should move a short distance away, until normal conversations can be understood (administrative control). This will preclude the possibility that we will receive noise doses in excess of

the OSHA Action Level. **Thus, because of the inherent mobility afforded most of our project personnel, it is our goal that employees never exceed the OSHA TWA Action Level of 85 dBA**. These OSHA limits are shown in Table 1.

Table 1

OSHA Action Level

Continuous Noise

Duration Per Day (Hours)		Action Level (dBA)*[1]
16		80
8		**85**
4		90
2		95
1		100[2]
0.5	(=30 minutes)	105
0.25	(=15 minutes)	110
0.125 or less	(< 7.5 minutes)	115

* Measured on the A-scale of a standard sound-level meter set at slow response.

Protection against the effects of noise exposure shall be provided at no cost to the employee, and must be worn, whenever sound levels exceed those in Table 1.

Whenever an employee's noise exposure equals or exceeds an eight-hour time-weighted average of 85 dBA, the employee shall be enrolled in HDR's Hearing Conservation Program. Elements of HDR's Hearing Conservation Program include audiometric testing and training.

[1] Note that every 5-decibel increase is a doubling of the sound pressure level, and therefore cuts the permissible exposure time in half. This 5 dB doubling value is termed the "exchange rate" and is admittedly imprecise; other countries use a 3 dB exchange rate.

[2] When continuous sound pressure levels exceed 100 dBA on a time weighted basis, both plugs AND muffs must be worn simultaneously. When both are worn, add 5 to the half-value NRR of the higher published NRR to obtain the combination protection afforded. For example, if the NRR for the plugs is 24 and the muffs is 20, then the actual reduction in noise decibels afforded is 24/2=12 + 5 = 17.

For purposes of the Hearing Conservation Program, employee noise exposures shall be computed without regard to any attenuation provided by the use of personal protective equipment.

7.2 Maximum & Impact Noise Limits

For practical purposes, exposure to continuous noise above 115 dBA for any length of time is not permitted unless hearing protection is worn. The maximum exposure limit for impact noise is 140 dB (measured on any scale).

7.3 Speech Interference and Annoying Noise

In some cases noise may not exceed standards established to protect hearing, but still interferes with speech or causes annoyance, either of which can reduce productivity. Although there are no mandatory standards for nuisance noise in the occupational setting, these guidelines and recommendations should be followed to protect employees from exposure to this type of noise.

Speech Interference

Most of the information conveyed through speech is in the mid-frequencies -- from about 500 to 2000 Hz. Thus, noise in these frequencies often interferes with speech recognition. Mid-frequency range levels below 50 dB are desirable in a typical conference room; those above 70 dB often present a problem in such settings. Background mid-range noise levels above 60 dB make telephone conversation difficult. If elimination and/or reduction of this noise is infeasible, ear protection designed to filter some of the noise in the mid-ranges may make speech easier to understand.

Annoying Noise

Noise may be annoying because of its level, frequency, or aspects of its modulation. A noise may not be very “loud”, but its frequency may be high enough to cause headaches in susceptible individuals. Alternatively, a noise may not be that loud but may start and stop suddenly. This can disturb concentration or frighten exposed personnel. Annoyance caused by irregular noises can sometimes be masked by running an appliance, such as a fan, that generates a low constant “white” noise.

8.0 CONTROL OF NOISE EXPOSURE

The three ways to reduce employee noise exposure are through the use of:

- Engineering controls - Best option

- Administrative controls - Good option
- Hearing protectors – Worn when other controls fail.

8.1 Engineering Controls

Engineering controls are defined as a permanent reduction in noise through any modification, insulation, isolation or replacement of the noise source. Examples include replacing old, noisy equipment; increasing sound dampening around equipment; or improving muffler design. Engineering controls should be formally considered before other types of controls are implemented. This is the best, and only permanent, option to eliminate the hazards posed by excessive noise. Unfortunately, HDR employees do not typically control noisy operations or mechanical noise sources, so we will rarely be able to implement engineering controls.

Any reduction in employee noise exposure is beneficial. However, if engineering controls are infeasible, or fail to reduce sound levels to within the limits of Table 1, administrative controls or usage of hearing-protective equipment must be used.

8.2 Administrative Controls

Administrative controls are changes in work schedules or operations to reduce the employees total noise dose. Common administrative controls include increasing the distance between the noise source and the worker, or reducing exposure time through job rotation. 2nd best option. **Because our workers are not tied to one project site location, this will be the easiest, inexpensive and most frequently implemented form of noise exposure control for HDR project personnel.**

In essence, implementing administrative control simply

means moving well away from the noise source!

8.3 Hearing Protectors

Hearing protectors should only be used as a last resort when engineering and administrative measures have been considered, and further protection is still needed. Hearing protection must be worn by HDR personnel when the workplace noise levels are:

- Greater than the Action Level(s) shown in Table 1 (continuous noise), or
- 120 + dB peak sound pressure level (impact noise)

Hearing protectors must reduce employee noise exposure, inside the ear, to a level of 85 dBA or below. Each hearing protector will state, on the package, a "noise-reduction rating" (NRR) number, which is the level of noise reduction (in decibels) the protector will provide if it is fitted and worn properly. The larger the NRR value, the better protection is afforded. In real practice, however, the advertised NRR is rarely achieved (especially for plugs), because of variability in workers ear canal size, improper installation, etc. Therefore, OSHA assigns a real-world attenuation value by dividing the advertised NRR rating in half. So a plug with an NRR of 24 would actually reduce the "noise level" inside the ear by 12 decibels. **HDR will use this "half-value" safety factor when determining the adequate protection needed.**

Although typically rated at lower NRR values, muffs (which can be attached to the hardhat) often provide superior protection to plugs, since there is less error in fitting and use. They also are more hygienic. HDR employees may select any plug or muff they prefer, as long as it has a sufficient NRR "half-value" rating to reduce the environmental noise below 85 dBA inside the ear. Plugs should carry a minimum rating of 24 (Half-value = 12 dB); good muffs will carry a rating of at least 20 (Half-Value = 10).

Types of Hearing Protective Devices (Ear PPE)

a. **Insert Type Earplugs**

Hearing protection is provided at no cost to HDR employees. These devices are designed to provide an air-tight seal with the ear canal. There are three types of insert earplugs - premolded, formable, and custom earplugs.

1. **Premolded Earplugs**

   Premolded earplugs are pliable devices of fixed proportions. These are available in two standard styles, single flange and triple flange, come in various sizes, and will fit most people. While premolded earplugs are reusable they may deteriorate, and should be replaced periodically.

2. **Formable Earplugs**

   Formable earplugs come in one standard size. Most are made of material which, after being compressed and inserted, expands to form a seal in the ear canal. After insertion, each earplug must be held in place while it expands enough to remain firmly seated. When properly inserted, they provide noise attenuation values that

are similar to those from correctly fitted premolded earplugs. These are typically considered disposable after one day's use; some manufacturers, however, may authorize longer periods of use.

3. **Custom Molded Earplugs**

   A small percentage of the population cannot be fitted with standard premolded or formable earplugs, due to small ear canals, ear injury, etc. In these cases, custom earplugs can be made to fit the exact size and shape of the individual's ear canal. These plugs are expensive, and muffs should be tried before ordering custom plugs. The HDR Director of Safety should be consulted prior to purchase. Individuals needing custom earplugs will be referred to an audiologist.

b. **Earmuffs**

Earmuffs are cup devices worn over both ears to reduce the level of noise that reaches the ear. Their effectiveness depends on an air-tight seal between the cushion and the head. Because of seal interference, large earrings should not be worn with muffs. Generally, earmuffs are more likely to be worn correctly than are earplugs; thus, the actual noise reduction provided by earmuffs in the field is closer to the stated value. Additional advantages are: (1) it is easier to verify that employees are wearing muffs in noise hazard areas than plugs, (2) muffs provide insulative protection in cold weather, and (3) it is easier to momentarily remove muffs to converse than to remove plugs, and more hygienic, since the user does not have to handle the skin-muff surface area.

One brand of muff highly recommended is Peltor™, available through safety catalogs, or from most local safety suppliers.

9.0 NOISE MONITORING

Noise is measured through the use of two instruments – **Sound Level Meters (SLM)** and **Noise Dosimeters**. SLMs are hand-held instruments that give an immediate reading of the noise at that instant of time. SLMs are used to survey an area or operation.

Dosimeters are worn on the hip with a wire running to a microphone that is clipped to an employee's shirt lapel. The dosimeter is usually worn all day, and will take readings each second, adding them to the sum total, and gives a cumulative average noise exposure value (dose) representing the period sampled (Any employee sampled must be notified of the results). Dosimeters incorporate all continuous, intermittent and impulsive sound levels from 80 to

130 dBA into the TWA dose value. These are used to determine personnel exposures, and to verify compliance with the limits presented in Table 1.

On construction sites, since project conditions change constantly, dosimeter personnel sampling is rarely performed. Potential noise levels are more frequently estimated by use of an SLM or by assuming overexposure, and enrolling project personnel in the HDR hearing conservation program.

As a general guideline, if employees are unable to converse with each other, in a normal tone and volume, at a distance of 3 feet or less, ambient noise levels will generally exceed 85 decibels.

10.0 MEDICAL SURVEILLANCE

NOTE: Employee noise exposure shall be determined without regard to any sound attenuation provided by the use of hearing protectors.

If any HDR employee is, or is expected to be, routinely occupationally exposed to continuous noise at or above the Action Level (regardless of whether ear protection is worn), the employee shall be enrolled in HDR's Hearing Conservation Program. The Hearing Conservation Program complies with the requirements of 29 CFR 1910.95 and includes:

- Annual education on the health effects of noise exposure and instructions on how to fit and wear hearing protectors;
- A baseline audiogram, and annual follow-up audiometric testing.

To enroll in the HDR Hearing Conservation Program, contact the Corporate Health & Safety Department.

The H&S Department will direct the employee to contact an approved clinic in the employee's locale. The employee shall receive initial information concerning the effects of noise, the purpose of audiometric testing, and a survey of any pre-existing medical conditions that may adversely impact the audiometric test. The employee shall provide information regarding their work history to document past noise exposures, and possible nonoccupational noise exposures.

The employee must have no apparent or suspected ear, nose, or throat problems that might compromise the validity of the audiogram. If an employee is determined to be suffering from an acute disease, which may compromise the validity of the test, the baseline audiogram will be delayed until the condition has abated.

When it is discovered that employees have been working where they encounter hazardous noise or incur exposures that exceed the Action Level and have not had a baseline audiogram, one shall be conducted within 30 days. The audiogram must follow at least 14 hours of no known exposure to sound levels in excess of 85 dBA. This "quiet time" interval will allow recovery from a noise-induced temporary threshold shift, should one have occurred.

Standard Threshold Shift - If any annual audiogram result indicates that a standard threshold shift has occurred, the affected employee shall be notified of this fact, in writing, within 21 days of the determination. A retest shall be conducted within 30 days of the first audiogram, with that result considered the annual audiogram. The physician may request further medical evaluation, and the affected employee shall be either removed from the high-noise environment or required to wear hearing protection.

Existing Ear Disease - Personnel who suffer from acute diseases of the ear shall not be placed in hazardous noise areas until the condition has abated, particularly if such diseases preclude the wearing of hearing protectors, cause hearing impairment, or produce tinnitus.

Exit Audiogram -All HDR employees participating in the Hearing Conservation program shall receive a final audiometric examination before termination of employment with HDR or after job changes that would alter noise exposure.

11.0 EMPLOYEE TRAINING

Each employee who participates in the Hearing Conservation Program shall receive annual training. The OSC is responsible for providing this training. This information may be presented through the use of videos, available from corporate safety. The training program will provide information about the adverse effects of noise; and how to prevent noise-induced hearing loss. At a minimum, all training will cover the following topics:

a. Noise-induced hearing loss;

b. Recognizing hazardous noise;

c. Symptoms of overexposure to hazardous noise;

d. Hearing protection devices - advantages and limitations;

e. Selection, fitting, use, and maintenance of ear PPE;

f. Explanation of noise measurement procedures;

g. Hearing conservation program requirements.

Employees will also be provided access, through our H&S Intranet site, to the OSHA noise standard (29 CFR 1910.95) and this Procedure.

HDR employees are also encouraged to use hearing protective devices when they are exposed to hazardous noise during activities at home; e.g., from lawn mowers, chain saws, etc.

12.0 RECORD KEEPING

Audiograms and noise-exposure records shall be maintained as a permanent part of employee medical records. If noise exposure measurement records are representative of the exposures of other employees participating in the Hearing Conservation Program, the range of noise levels, and the average noise dose will additionally be made a permanent part of the medical records of the other employees.

In addition to audiometric test data, each medical record will, at a minimum, identify:

- The audiometric reference level to which the audiometer was calibrated at the time of testing.
- The date of the last calibration of the audiometer.
- The name, the social security number, and job classification of the employee tested.
- The employee's most recent noise exposure assessment.
- The date(s) hearing conservation training was received.

Accurate records of the background sound-pressure levels in the audiometric test rooms, and data and information concerning calibration and repair of sound-measuring equipment and audiometers (as well as all audiometric test data) will be maintained for the duration of the affected employee's employment.

13.0 REFERENCES

1. Occupational Noise Exposure, 29 Code of Federal Regulations (CFR) 1910.95 [General Industry], and § 1926.52 [Construction].

2. American Conference of Governmental Industrial Hygienists (ACGIH), Threshold Limit Values and Biological Exposure Indices for Physical Agents in the Work Environment, Noise, current edition.

3. NIOSH, A Practical Guide to Effective Hearing Conservation Programs in the Workplace, September 1990.

4. Video, “Sound Advice: Hearing Conservation on the Jobsite”, HDR #0020.

1.0 OBJECTIVE

HDR Inc., (HDR) employees frequently perform services in high temperature/humidity areas, where extended exposure could result in heat-related disorders. This procedure describes the hazards associated with exposure to high thermal temperatures, and the proper responses that will prevent or minimize adverse health effects. The guidelines contained in this procedure are in conformance with both the Occupational Safety and Health Administration's (OSHA) 5(a)(1) general duty clause, and the recommendations presented in the publication, *Threshold Limit Values for Chemical Substances and Physical Agents (latest year)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

2.0 PURPOSE

The purpose of this Procedure is to present information regarding the hazards and physiological effects of exposure to high temperatures, and the recommended work practices to avoid illness due to heat strain.

3.0 APPLICABILITY

The HDR Heat Prevention Program implemented in this Procedure applies to all HDR personnel at both HDR client sites and all HDR facilities, when faced with exposure to hot environments. All employees, regardless of HDR Department, could be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected, and
- Assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this Procedure, as applicable, to office staff, and make sure that this Procedure is readily available in each office, and
- Interface with the Director of Safety regarding any high-heat office or project site conditions that have been discovered, and need addressing or interpretation.

Project Health and Safety Officers. Project Health and Safety Officers (HSO) shall:

- Verify that initial training on this Procedure has been received by their respective project staff, if applicable, and make sure that this Procedure is available at the project site, and
- Interface with the OSC and/or Director of Safety regarding any heat stress project site conditions that are present (with the potential for generating heat strain) and need addressing or interpretation.

5.0 DEFINITIONS

Aural – The external, visible ear structure (pinnae).

Heat Stress – The terms "heat stress" and "heat strain" are erroneously used interchangeably, when in fact there is a distinct difference. Heat Stress is any external environmental heat stimulus that causes your body to react outside its normal range of activities. Put another way, heat stress is the cumulative environmental condition (hot outside temperatures, high humidity, winds, etc.) that cause your body to react. Heat stress is a necessary precursor to heat strain. Each individual may react differently to heat stress, depending on individual susceptibility to heat, age, physical condition, alcoholic intake, etc. Heat stress does not necessarily result in adverse health effects.

Heat Strain – Heat strain is the human body's physiological response to heat stress. Excessive heat strain results in a heat-related disorder.

Environmental Monitoring – Determines the degree of heat stress. Determined by the use of a WBGT monitor, with the numerical result compared against the ACGIH developed limits presented in Table 1. Used by OSHA to substantiate overexposures to heat stress. General indication of the potential for exposed employees to suffer heat strain.

Physiological Monitoring – Measurement of the individual employees' physical response to the heat stress conditions; a specific measure of the degree of heat strain.

WBGT – Acronym, means "Wet Bulb Globe Temperature." A numerical reading, in Fahrenheit (F°) or Celsius (C°), developed by integrating the following 3 parameters:

- ✓ **Ambient temperature – Dry Bulb Thermometer**
- ✓ **Wind & Humidity – Static Wet Bulb Thermometer**
- ✓ **Radiant Heat – Globe Thermometer**

Usually determined through the use of a WIDGET™ integrated monitor or equivalent (available through rental companies).

6.0 GENERAL DISCUSSION

6.1 The Body – Heat Evolution and Dissipation

Overview

Human beings are warm-blooded, or homeothermic. We produce heat, through the chemical breakdown of food, to supply our internal body environment. In order for the metabolic processes to operate, to break down food into energy, to utilize oxygen and to get rid of wastes, the internal environment within the body must be kept within a very narrow temperature range ("homeostasis"). All of the hundreds of thousands of chemical reactions that occur each second in our body are only designed to operate within this narrow temperature range. Outside this range, these metabolic processes cannot proceed efficiently. Thus, it is critical to our well being that we maintain a uniform, constant internal temperature. The average human deep body temperature (referred to as the "core body temperature") is 37.7° Celsius or 99.6° Fahrenheit. The average body temperature that we are all familiar with, 98.6° F is the "oral" temperature.

Heat Gain and Loss

The metabolic heat generated by the average person sitting quietly is about equal to that of a 100-watt incandescent light bulb. We also acquire, or gain, heat from outside sources, such as the sun or from exposure to radiant heat sources, such as molten metal in a foundry. A small percentage of this heat, whether generated internally or acquired externally, is used to maintain our critical, narrow body temperature range. The excess heat is transported by our blood to the skin surface as well as our lungs, where it is transferred to the air within. This unneeded excess heat is then shed by breathing it out, by losing it

to cool wind currents or cool objects that contact our skin, or by the process of sweating.

Sweating is Heat Loss

When our body has excess heat present, nerve messages from the brain automatically start the process of sweating. Remember that it takes the input of energy to raise matter from a dense (low) matter state to a less dense (higher) state. In order for water (sweat) on your skin surface to change into water vapor (evaporate), energy must be added. Approximately 80 calories of energy are required to evaporate 1 gram of water. That energy is in the form of body heat, because heat is energy. Therefore, as you sweat, and the sweat evaporates, you lose heat.

Humidity Effects on Heat Gain/Loss

We have all heard of the weather term "relative humidity (RH)". Relative humidity is a ratio of the amount of water in the air, at a specific temperature, compared to the maximum absolute amount that it could hold. Warm air can hold more water than cold air (So when warm, moist air cools down, it rains). The human body can only lose heat through sweat evaporation if the air can accept the water vapor. Sweat will rapidly evaporate and cool the body when a low relative humidity is present. But if the RH is high, sweat will sit on the skin, and no benefit (heat loss) will be gained from sweating. The body will continue to sweat in an attempt to shed heat, and dehydration is a dangerous possibility. If the RH is 100%, the body cannot lose any heat through sweating.

Now that we understand how the body loses heat, let's look at the effect that clothing has on this process.

6.2 Effects of Protective Clothing (PPE)

All clothing affords some protection from exposure to the elements, and therefore, retards the efficient circulation of air. This reduction of air movement reduces the evaporation of sweat (transpiration), the loss of heat through direct air movement (convection) and to a lesser degree, the loss through direct contact with cooler surrounding objects (conductance). Conversely, clothing will prevent conductance through contact with hotter objects, as well as radiant heat gain from sunshine and hot nearby objects.

Normal work clothing, which allows some (although restricted) passage of air and sweat from the skin to the environment, is considered *permeable*. The restriction of air circulation is not usually of significant health concern, unless the volume of clothing worn is great.

Some personal protective equipment and clothing (PPE), such as Tyvek™ coveralls, respirators, etc. are designed to prevent air/liquid environmental contaminants from passing through the clothing and contacting the skin. Unfortunately, the *impermeable nature of this fabric also prevents* heat and sweat from passing through the PPE and escaping the suit. Additionally, the extra weight of this equipment and clothing, and the restriction of body motions that bulky PPE imposes, causes the wearer to work harder than normal, and more heat is generated. Thus, when impermeable PPE is worn, more metabolic heat than usual is generated, and the heat cannot readily escape the clothing. Cool outside air temperatures do not help significantly, since the PPE is impermeable. So wearing this PPE is equivalent of wearing a sauna around the body, and the body responds by producing more sweat. Therefore, use of impermeable protective clothing can greatly increase the potential for heat-related illnesses, even in relatively benign ambient temperatures.

7.0 HEAT-RELATED ILLNESSES

There are four typical types of heat-related illnesses (result of heat strain) resulting from prolonged exposure to high thermal environments (stressor which causes the strain). These are described below:

7.1 Heat Rash (Prickly Heat)

Heat rash is a painful temporary condition caused by clogged sweat pores, typically from hot sleeping quarters.

Commonly observed in tropical climates, heat rash is caused by the plugging of sweat ducts due to the swelling of the moist keratin layer of the skin which leads to inflammation of the sweat glands. Heat rash appears as tiny red bumps on the skin, and can impair sweating, resulting in diminished heat tolerance. It is not a common concern in North American employment. Heat rash can usually be cured by providing cool sleeping quarters; body powder may also help absorb moisture.

7.2 Heat Cramps

Heat cramps are characterized by painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Heat cramps usually occur after heavy sweating, and often begin at the end of the workday. The cramps are caused by a loss of electrolytes, principally salt. This results in fluids leaving the blood and collecting in muscle tissue, resulting in painful spasms. Treatment consists of increased ingestion of commercially available

electrolytic “sports” drinks (because of individual sensitivity, it is best to double the amount of water required by package directions, or add water to the liquid form).

7.3 Heat Exhaustion

This condition is characterized by profuse sweating, **weakness**, low blood pressure, rapid pulse, dizziness, and frequently nausea and/or headache. The skin is cool and clammy, and appears pale. The body core temperature is normal or depressed. Victim may faint and/or vomit. First aid consists of placing the victim in a cool area, loosen clothing, place in a head-low (shock prevention) position, and provide rest and plenty of fluids. This is the most common form of serious heat illness encountered during employment activities. **Any worker who is a victim of heat exhaustion may not be exposed to a hot working environment for an absolute minimum of 24 hours, and if fainting has occurred, the victim should not return to work until authorized by a physician.**

7.4 Heat Stroke

This is the most serious heat disorder, and is life-threatening. Heat stroke is a true medical emergency. This results when the body's heat dissipating system is overwhelmed and shuts down (thermoregulatory failure). Heat stroke results in a continual rise in the victim's deep core body temperature, which is fatal if not checked. The symptoms are hot, dry, flushed skin, elevated body core temperature, convulsions, delirium, unconsciousness, and possibly, death. First aid consists of immediately moving victim to a cool area; cool the body rapidly by immersion in cool (not cold) water or sponging the body with cool water; treat for shock and obtain immediate medical assistance. Treatment response time is critical when assisting a victim of heat stroke! Do not give coffee, tea or alcoholic beverages.

8.0 HEAT MONITORING

There are two methods of monitoring for the detection of heat-related illnesses – environmental monitoring (monitoring heat stress) and physiological monitoring (monitoring heat strain).

8.1 Environmental Monitoring (Heat Stress Monitoring)

8.1.1 Description

Typical industrial control of heat **strain** is accomplished by reducing the heat stress through environmental/administrative controls, such as cooling the work area, installation of fans, shielding radiant heat sources such as furnaces, elimination of steam leaks, or rotating employees to reduce exposure time. These control methods are practical and feasible for workers wearing normal permeable work clothing in inside, fixed-location facilities.

OSHA currently does not have a promulgated health standard on heat (or cold) stress. When inspecting the typical industrial workplace, OSHA compliance officers verify that workplace environmental conditions are acceptable for the work being performed by using the WBGT Heat Stress Index (Table 1). To determine the numerical enforcement value (permissible exposure limit), OSHA utilizes a WBGT monitor that incorporates real-time readings for ambient temperature, radiant heat load, and humidity (wind speed is factored indirectly). This method of monitoring the ambient environmental conditions in the workplace, and making assumptions about its effect on every exposed worker is termed "**environmental"** monitoring. OSHA utilizes this type of monitoring because it is non-invasive to the employee, and generates a single value that can be compared against a standardized numerical exposure limit, shown in Table 1. Overexposures are cited under the OSHA general duty clause. The WBGT heat stress index, while not correlating especially well with heat strain, has been used for many years by the military and has the official sanction of the American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH).

8.1.2 Procedure

In using this method, frequent readings (every 15 minutes is recommended, every half-hour is minimally acceptable) should be taken and averaged at the end of the workday. If the final value exceeds the Index Table value, an overexposure has occurred.

8.1.3 Limitations

This method of monitoring is appropriate for monitoring inside or outside areas, but only when the workers are wearing permeable, normal work clothes (jeans, dress attire, etc.)

One problem with this method is the fact that work in naturally hot outside environments, such as in southern states during the summer, will consistently yield WBGT readings in excess of the Index Table limits, often before 10 a.m. Strict adherence to these values would prevent work at these locations for several months each year, while not proving heat-induced illness has occurred. Therefore, since this method only measures the environmental conditions, not the employee response to these conditions, it is not typically used when performing outside site activities. In these situations, physiological monitoring is more appropriate.

Table 1

Examples of Permissible Heat Exposure Threshold Limit Values
[Values are given in ºC and (ºF) WBGT]*

	WORK LOAD							
	ACCLIMATIZED				UNACCLIMATIZED			
Work–Rest Regimen	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
Continuous work	29.5 (85)	27.5 (81)	26 (79)		27.5 (81)	25 (77)	22.5 (73)	
75% Work–25% Rest, each hour	30.5 (87)	28.5 (83)	27.5 (81)		29 (84)	26.5 (80)	24.5 (76)	
50% Work–50% Rest, each hour	31.5 (89)	29.5 (85)	28.5 (83)	27.5 (81)	30 (86)	28 (82)	26.5 (80)	25 (77)
25% Work–75% Rest, each hour	32.5 (90)	31 (88)	30 (86)	29.5 (85)	31 (88)	29 (84)	28 (82)	26.5 (80)

* As workload increases, the heat stress impact on an unacclimatized worker is exacerbated.

For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5º C.

8.2 Physiological Monitoring (Heat Strain)

8.2.1 Description

Heat strain results in an increase in heart rate, as the cardiovascular system works harder to bring heat from the deep parts of the body to the skin surface. Since heat is being generated faster than it can be shed, the body temperature also rises. So heat strain can be measured by comparing a worker's temperature and pulse rate against his/her normal "resting" values.

Physiological monitoring is the method adopted by OSHA to monitor employees who are wearing impermeable clothing while performing services. A through presentation of the components of a good **physiological** monitoring program (written for Hazardous Waste Site workers, but the principles remain the same) is presented in the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, produced by NIOSH/OSHA/USCG/EPA, October 1985 (available from corporate safety).

The HDR physiological monitoring protocol, presented below, incorporates the core features of these recommendations (with improvements, based on experience and current ACGIH information).

8.2.2 When to Institute Physiological Monitoring

The necessity to conduct heat strain monitoring is site-specific, and no definite "absolute" answer can be given. The following factors should be warning flags that may require the initiation of monitoring:

- Performing extended outside services during **summer months**. Begin monitoring when ambient temperature are consistently (greater than ½ the workday) above 80° F (26.7° C), especially when relative humidity exceeds 80%;
- Performing extended outside services on project sites located in the **deep south**;
- Performing extended services in the proximity of **radiant heat sources** (foundries, etc.);
- Presence on-site of an employee with a **history of heat illness**;
- Requirement to wear **impermeable PPE at any temperature**.

While ambient temperatures in the southwest routinely exceed 80° F, relative humidity levels are typically very low. This, combined with the acclimatization of the HDR employees accustomed to the climate and the employees' ability to access cool shelter when desired, will minimize the necessity to monitor on many project sites. Again, each project site and set of employee tasks is different; project personnel should consult their OSC or the Director of Safety if guidance is needed.

8.2.3 Procedures

The HDR physiological monitoring program consists of monitoring each affected employee by the simultaneous monitoring of the following two parameters:

1. **Heart rate** - Each individual will count his/her radial (wrist) pulse upon arriving at the site, prior to work each morning. This will be considered the "background", or resting pulse. This information will be provided to the project Health & Safety Officer (HSO). This provides the HSO with the "normal" resting pulse of that employee, since people exhibit a natural variability in pulse rates. Then each employee will monitor his/her pulse for 30 seconds as early as possible at the beginning of each rest period (breaks, lunch, end of workday). If the heart rate of any individual exceeds 110 beats per minute at the beginning of a rest period, then the subsequent work cycle will be decreased by one-third. The rest period length will remain the same.

2. **Aural temperature** - Each individual will measure his/her aural (ear) temperature with an electronic ear clip/scan thermometer at the same time, and on the same schedule, as the pulse readings. Past use has shown a close correlation between oral and aural temperatures (oral temperature collection by use of thermometers is allowed, but discouraged, due to the invasiveness of the procedure and the issue of hygiene). This temperature is also correlated with the deep core body temperature, which is what is important. If the aural temperature exceeds 99.6° F at the beginning of the rest period, then the work cycle will be decreased by one-third. The rest period will remain the same. At no time will any employees aural temperature be allowed to exceed 100.4° F (38° C); if exceedance occurs, the employee shall not be permitted to continue to work in the hot environment, but must rest in a cool location, be provided cool drinks (non-caffeinated, non-alcoholic), and not return to the hot work environment until the following day. (NOTE: The new battery-powered ear scan digital thermometers, which read the temperature of the eardrum, are recommended for project work. They cost about $50 and are readily available through any national chain discount store. Individual-use covers are placed over the scanner probe, and discarded between users, thus avoiding any hygiene concerns. An adequate number of covers should be maintained on-site.)

   The project or designated HSO shall record all monitoring results on the HDR Heat Stress Log (see example, Attachment A). The designated HSO shall have a minimum of current Red Cross first-aid certification (which includes training to recognize the symptoms of heat-induced illness). **NOTE: If initial results indicate that the site acclimatized workers are not suffering any symptoms of heat induced strain, then the HSO may contact the HDR Director of Safety and request to reduce the level of future monitoring.**

9.0 PREVENTION OF HEAT DISORDERS

It is interesting to note that if a person works continually, for about a week, in a hot environment, he/she tolerates much hotter conditions than initially. This process of adjustment is termed "acclimatization", and it has been intensively studied and is well known. Acclimatization is essential if work is to be frequently performed in hot environments. Essentially, in acclimatized workers, their core body temperatures and heart rates are slower than non-acclimatized workers, and they sweat more but with less salt loss. Acclimatization to heat can, however, be lost almost as rapidly as it is acquired, if the worker is removed from the hot environment for a few days.

In order to prevent the onset of heat-related disorders, HDR employees should rely on the physiological monitoring methods described above, and practice good health measures, such as:

- Maximize daily fluid intake and realize that thirst is not an adequate indicator of sweat loss. Cool water or other non-alcoholic beverages should be consumed at a target rate of one cup every 20 minutes at a minimum. The beverages should be cool (50 to 60° F), and readily available;
- The workers should be as physically fit as possible. This is especially important concerning hot work. Obesity predisposes individuals to heat disorders;
- The rest area should be shaded from the sun, and cool (air-conditioned if possible);
- Older workers are at a disadvantage in hot work because the aging process results in a sluggish response of sweat glands, resulting in a less effective control of body temperature;
- A victim of a heat-related disorder is permanently predisposed to suffering a recurrence;
- Every worker is unique in his/her ability to handle heat. Work/rest periods should be based on the individual's capacity to safely handle the heat, not on a predetermined or inflexible time length;
- Alcohol has been commonly associated with the occurrence of heat-related disorders. Alcohol reduces heat tolerance;
- Inform female workers of the possible adverse consequences of hot work while pregnant, due to elevated core body temperatures.

HDR HEAT STRESS LOG

Name	Date & Time	Air Temp. ºF/% Sunshine	Resting Heart Rate (IF OVER 110 BPM, REDUCE WORK PERIOD)	Aural/Oral (circle one) Temperature (if over 100.4 F, remove from heat)

1.0 OBJECTIVE

HDR Inc., (HDR) employees frequently perform project services in cold environmental temperatures, where extended exposure could result in cold-related disorders. This procedure describes the hazards associated with exposure to low temperatures, and the proper responses that will prevent or minimize adverse health effects. The guidelines contained in this procedure are in conformance with both the Occupational Safety and Health Administration's (OSHA) 5(a)(1) general duty clause, and the recommendations presented in the publication, *Threshold Limit Values for Chemical Substances and Physical Agents (latest year)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

NOTE: This Procedure has been revised to reflect the National Weather Service's November 1, 2001, modifications to the Wind Chill index.

2.0 PURPOSE

The purpose of this procedure is to present information regarding the hazards and physiological effects of exposure to low temperatures/water/wind, and the practices that should be implemented to prevent cold-induced injury. The purpose is ultimately to protect our employees from a dangerous drop in deep core body temperatures ("hypothermia"), and to prevent cold injury to body extremities ("frostbite").

3.0 APPLICABILITY

The HDR Cold Stress Prevention Program implemented in this Procedure may apply to all HDR personnel at both HDR client sites and all HDR facilities, when faced with exposure to cold environments. All employees, regardless of HDR Department, could be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

National Director of Safety. The Director of Safety shall:

- Periodically review, at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and
- Assist OSCs and project professionals, as requested, in the implementation of this procedure and regulatory interpretations.

Office Safety Coordinators. The OSCs shall:

- Provide initial training on this procedure to their respective office staff, and make sure that this procedure is readily available in each office; and
- Interface with the Director of Safety regarding any office or project site conditions that have been discovered to present dangerously low absolute or wind chill temperatures, and need addressing or interpretation.

Site Health and Safety Officers. The Site Health and Safety Officers (HSO) shall:

- Verify that initial training on this procedure has been received by their respective project staff (as applicable), and make sure that this procedure is available at the project site; and
- Interface with the OSC and/or Director of Safety regarding any cold stress project site conditions that are present (with the potential for generating cold disorders), and need addressing or interpretation.

5.0 DEFINITIONS

Wind Chill – The wind chill temperature is the temperature that it feels like outside to people and animals. Wind chill is based on the rate of heat loss from exposed skin caused by combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the both the skin temperature and eventually the internal body temperature. Therefore, the wind makes it feel much colder. If the temperature is 0° Fahrenheit and the wind is blowing at 15 mph, the wind chill is -19° Fahrenheit. At this wind chill temperature, exposed skin can freeze in 30 minutes.

Information provided in this Cold Stress Procedure reflects the latest National Weather Service (NWS) revisions to the Wind Chill index. Specifically, the new WCT index:

- uses calculated wind speed at an average height of five feet (typical height of an adult human face) based on readings from the national standard height of 33 feet (typical height of an anemometer);
- is based on a human face model;
- incorporates modern heat transfer theory (heat loss from the body to its surroundings, during cold and breezy/windy days);

- lowers the calm wind threshold to 3 mph;
- uses a consistent standard for skin tissue resistance; and
- assumes no impact from the sun (i.e. clear night sky).

The Wind Chill Table, presented in the Appendix to this Procedure, should be reviewed along with local temperature and wind speed data prior to extended work in the cold, and preventative work restrictions and preventions, presented herein, should be followed.

Frostbite - Frostbite occurs when body tissue freezes and damage to that tissue occurs. The most susceptible parts of the body are the extremities such as fingers, toes, ear lobes, or the tip of the nose. Symptoms include a loss of feeling in the extremity and a white or pale appearance. Medical attention is needed immediately for frostbite. The area should be SLOWLY re-warmed.

Hypothermia - Hypothermia is when the body temperature falls below 95° Fahrenheit. Determine this by taking ones temperature. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. Medical attention is needed immediately. If it is not available, begin warming the body SLOWLY. Warm the body core first, not the extremities. To warm the extremities first, drives the cold blood to the heart and can cause the body temperature to drop further which may lead to heart failure. Get the person into dry clothing and wrap in a warm blanket covering the head and neck. Do not give the person alcohol, drugs, coffee, or any HOT beverage or food. WARM broth and food is better. NOTE: Alcohol intake should be avoided prior to cold exposure, as it depresses body temperature.

(About 20% of all cold related deaths occur in the home. Young children under the age of two and the elderly, those over 60 years of age, are most susceptible to hypothermia. Hypothermia can set in over a period of time. To avoid this problem, keep the thermostat above 69° Fahrenheit; wear warm clothing; eat food for warmth and drink plenty of water (or fluids other than alcohol) to keep hydrated.)

Anoxia – lack of oxygen.

6.0 GENERAL DISCUSSION

The human body is designed to maintain a constant and uniform internal temperature. The average human deep body temperature (referred to as the "core body temperature") is approximately 99.6° Fahrenheit (37.7° Celsius). The

average body temperature that we are all familiar with, 98.6° F, is the "oral" temperature.

When the body loses heat faster than it can produce it, the result is hypothermia. Hypothermia means "low (body) temperature." This situation is initially characterized by the constriction of blood vessels in the skin in an attempt to conserve the body's internal heat. This protective action serves to trap the remaining heat inside the body cavity, where the vital metabolic processes are occurring, than to continue to let the bloodstream carry heat to the extremities (arms and feet), and lost to the environment through the skin. So at the outset of hypothermia, body areas with high surface area-to-volume ratios, such as fingers, toes and ears, are initially affected. If the body continues to lose heat, involuntary shivering begins. This is the body's attempt to generate additional heat, and it is usually the first real warning sign of hypothermia. Further heat loss produces speech difficulty, loss of manual dexterity, forgetfulness, collapse, and finally death. Clinical manifestations of the increasing loss of body heat are presented in Table 1.

While it is critical that the core body temperature be maintained in a relatively narrow range, the temperature of the hands and feet can drop as much as 40 to 50° F below normal body temperature without permanent injury, provided that the condition is relatively brief.

The body's "perception" of cold is a relative factor. Many cases of hypothermia have occurred in temperatures well above freezing. How fast heat is lost from the body is dependent upon many factors, not just air temperature. Moisture on the skin will conduct heat away from the body many times faster than dry skin (Water conducts heat 240 times faster than air).

Another way in which localized hypothermia, and actual frostbite can occur, is when the skin of a worker is exposed to an escaping gas with a high vapor pressure, or is in contact with a liquid with a very low boiling point. Examples include liquid ammonia, gasoline or various alcohols. All liquids must have heat added to them in order to evaporate (change of physical state). The liquid acquires the necessary heat from its immediate surroundings. If the liquid is on human skin, the heat will be drawn from the warm skin surface, resulting in very rapid cooling of the skin surface. Numerous cases of localized frostbite have occurred this way. Never allow a pressurized liquid to contact any exposed body part!

An important factor that determines the rate of cooling, and a term we are all familiar with, is "wind chill." The wind chill index is the cooling effect of any combination of cool temperature and wind speed (velocity). There is a thin layer of still air that surrounds the body, even when unclothed. This layer warms and

acts as an insulation blanket, keeping cooler environmental air away from the skin surface. When air is moving across your skin, it carries away this insulation layer of air. Heat brought from the body core to the skin surface, through the circulatory system, is then removed by the cooler air (conduction/convection).

The wind chill index is presented as an Appendix. Wind Chill is simply a number, calculated by the integration of the actual air temperature and the wind speed into a formula that indicates the perceived chill on the exposed skin. It is a measure of the chilling effect felt by a warm-blooded body.

Table 1

Progressive Clinical Presentations of Hypothermia*

Core Temperature		
°C	**°F**	**Clinical Signs**
37.6	99.6	"Normal" rectal temperature
37	98.6	"Normal" oral temperature
36	96.8	Metabolic rate increases in an attempt to compensate for heat loss
35	95.0	Maximum shivering
34	93.2	Victim conscious and responsive, with normal blood pressure
33	91.4	Severe hypothermia below this temperature
30	86.0	Progressive loss of consciousness; muscular rigidity increases;
		Pulse and blood pressure difficult to obtain; respiratory rate decreases
27	80.6	Voluntary motion ceases
26	78.8	Victim seldom conscious
20	68.0	Cardiac standstill
18	64.4	Lowest accidental hypothermia victim to recover
9	48.2	Lowest artificially cooled hypothermia patient to recover

* Presentations approximately related to core temperature. Modified from the *Threshold Limit Values for Chemical Substances and Physical Agents (1998)*, published by the American Conference of Governmental Industrial Hygienists (ACGIH).

7.0 COLD-RELATED ILLNESSES

There are four types of cold-induced injury resulting from prolonged exposure to a low Wind Chill Index. These are:

7.1 Hypothermia

Normally, the core body temperature should generally not be allowed to fall below 96.8° F (36° C), but one occasional excursion (per exposure) to 95° F (35° C) is permitted by the most current ACGIH Threshold Limit Value. This is the point that severe shivering occurs. As previously discussed in Section 6.0, hypothermia results when the body core temperature falls below 95° F (35° C). If the body core temperature drops below this critical level, the victim cannot produce enough body heat by himself to recover. At this point, a true medical emergency exists. Table 1 presents the clinical effects of hypothermia. True hypothermia always requires immediate attention, since untreated hypothermia can lead to ventricular fibrillation (heart attack) and death.

7.2 Frostbite

Frostbite is the actual freezing of body tissue. There are three degrees of frostbite:

- First degree: freezing without blistering or peeling;
- Second degree: freezing with blistering or peeling;
- Third degree: freezing with skin tissue death and possible deep tissue damage.

The extremities are most commonly affected, and therefore frostbite generally first appears in toes, fingers, nose and ears. The initial stage of frostbite is termed “Frost-Nip”, when only a localized, superficial freezing of extremities has occurred. Regardless of the Wind Chill, frostbite does not occur until the absolute ambient temperature falls below freezing, 32° F (0° C). However, frostbite can occur when bare skin comes into contact with objects whose surface temperature is below freezing, despite warm environmental temperatures. The first warning of frostbite is often a sharp prickling sensation. Frostbitten skin is characterized initially by turning red, then blue/red, and finally by loss of color and feeling in the affected tissue. The skin may become waxy pale in appearance because of a lack of oxygen. Frostbite damage **may be reversible** if properly treated in the first 12 to 24 hours. If not treated, frostbitten areas may become gangrenous. Workers who have suffered frostbite are susceptible to future recurrences and subsequent injury.

7.3 Immersion Foot

"Immersion foot" is caused by chronic cooling for prolonged periods, and is most commonly seen in workers who stand in cold water for long continuous periods. Injury is thought to be due to persistent local tissue anoxia, resulting in damage to the blood capillary walls. The condition may be aggravated by tight footwear. Industrially, trench workers are at risk. It is characterized by intense pain, tingling, itching and discoloration of the foot. Immersion foot is rarely observed now, but was once fairly common among mine workers and in trenching operations.

7.4 Raynaud's Phenomenon

The term "Raynaud's Phenomenon", also called "white fingers", is used to describe a vascular abnormality characterized by a loss of circulation associated with exposure to cold, and/or vibration. It is essentially a disorder of the blood vessels and nerves in the fingers. There is a historical background incidence in the general population of approximately 5 percent, with females being the most susceptible. The onset of Raynaud's Phenomenon is gradual, and is characterized by several stages. The initial stage is manifested by occasional pain, and a slight loss of hand sensitivity. If removed from cold and vibration, it is usually reversible at this stage. As the condition worsens, pain and numbness increases, and finger sensitivity decreases. As the blood vessels are damaged, blood flow slows and the skin temperature decreases. In the pronounced stages, fingers become white and the hands feel cold and moist. At this point, the condition is irreversible. Current research suggests that this disease appears to be related to vibrational energy in the 40-125 Hertz (cycles per second) range, and cold temperatures play a co-antagonistic role. Employees who routinely work in cold environments should limit the duration that they use rotating or vibrating tools.

8.0 FIRST AID

All cold related injuries require immediate removal from the cold environment and proper medical treatment. The supportive first aid measures included here are to be used only until proper medical treatment by a qualified physician can begin.

8.1 Hypothermia

Hypothermia is a life-threatening condition that requires immediate response. Remove the victim to a warm area out of any wind. All cold wet clothing should be removed, and the victim should be wrapped in warm blankets. Immediate medical attention should be summoned. The victim may be disoriented and

unable to talk clearly or understand simple questions. If conscious and able to converse, they may be given hot (non-caffeinated, non-alcoholic) liquids to drink, and sweetened foods high in carbohydrates. Keep victim awake until medical assistance arrives.

8.2 Trench Foot, Frostnip and Frostbite

The affected area should be gradually warmed (immediate or sudden heating of affected areas must be avoided, to minimize further tissue damage). Superficially frostbitten areas (characterized by a sudden blanching or whitening of the skin, firm to the touch, resilient tissue beneath) are best warmed by placing them next to warm skin. A good guideline when rewarming frostbitten areas is to not raise the temperature much above that of the body. The abdomen and the armpit are body areas that can be used to rewarm frostbitten areas. Deep frostbitten tissue is characterized by cold, pale or darkened tissue that is solid to the touch. Do not rub the frostbitten part, and do not break any blisters. Wrap the affected part lightly, and protect from further injury. Provide warm drinks (not caffeinated or alcoholic), and do not let the victim smoke. Remember that the tissue will be very painful as it thaws. The victim should not use the affected limb or area until cleared by a physician.

9.0 COLD MONITORING

OSHA currently does not have a promulgated health standard on cold stress. As in heat stress, OSHA enforces cold exposures by relying on the ACGIH TLV for cold stress, and would issue citations through the use of the general duty clause. The TLV objective is to prevent the deep body temperature from falling below 96.8° F (36° C), and simultaneous prevention of cold injury to body extremities.

Unlike heat stress, however, there is no currently available instrumentation that can effectively sample the Wind Chill, and warn of “overexposure.” Therefore, HDR will prevent cold-related disorders through compliance with the guidelines presented below.

10.0 PREVENTION OF COLD DISORDERS

10.1 Physiological Limits and Medical Considerations

1. Maximum **severe shivering** develops when the deep core body temperature falls to 95° F (35° C). Medical experience indicates that, beginning at this level of decreased core temperature, mental functioning becomes impaired. Therefore, exposure to cold should be immediately terminated for any HDR employee when observable shivering occurs.

The employee should warm up, and don additional clothing, before returning to the cold area. Unless there are unusual or extenuating circumstances, cold injury to the non-extremity portions of the body is unlikely without the development of the initial signs of hypothermia (severe shivering).

2. **Pain in the extremities** is commonly the first early warning sign of the onset of cold stress. While frostbite will occur only at absolute temperatures below freezing, 32° F (0° C), regardless of wind speed, unpleasant cold sensations in extremities may be felt at higher temperatures, and heat loss in extremities can assist in the onset of hypothermia. Don additional warm, dry clothing, especially on the affected body part (hands, feet, head).

3. Wear adequate insulating dry clothing if work is to be performed in air temperatures below 40° F (4° C). Below 40° F, use the wind chill values in Table 1 as guidelines for the relative danger posed by the ambient conditions, and add additional insulating layers of clothing as necessary.

4. Workers who are **suffering from diseases or taking medication that interferes with normal body temperature regulation**, or which reduces tolerance to cold environments, should be excluded from prolonged work in cold below 30° F (–1° C).

5. For **exposed** skin, continuous exposure should not be permitted when the wind chill reaches -25° F (–32° C). If outside work must be conducted in the extreme cold, cover all exposed skin with clothing, layering as necessary. Take frequent breaks in a warm shelter, loosening clothing to allow sweat to evaporate.

6. At air temperatures of 35.6°F (2°C) or less, it is imperative that **workers who become immersed in water or whose clothing becomes wet** (from external sources, not incidental sweat) be immediately provided a change of clothing and observed for symptoms of hypothermia.

7. Cold temperatures increase the susceptibility to **vibration-induced injury**. When working in cold environments, limit exposure time to vibrating tools and mechanical processes.

8. **Dehydration** occurs insidiously in cold environments, and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to replenish caloric intake and fluid volume. The intake of coffee, however, should be limited because of the diuretic and

circulatory effects. The same applies to alcohol consumption, which increases blood circulation to the skin, and interferes with mental acuity, which can lead to risk taking.

9. These recommendations apply to healthy employees in fair to good physical condition. Older employees, or those with circulatory problems may need to avoid extremely cold environments, or wear extra clothing; if in doubt, the employee should consult a physician familiar with cold stress factors and their medical condition.

10.2 Personal Protective Clothing Considerations

1. **Eye protection** for workers employed out-of-doors in a snow and/or ice covered terrain should be supplied. Safety glasses/goggles possessing ultraviolet/glare protection should be worn when there is an expanse of snow coverage causing a potential eye hazard from blowing ice crystals or reflective radiation.

2. In general, **gloves or mittens** should be worn whenever the air temperatures fall below 40° F. If the task precludes the wearing of gloves, then special provisions should be established to allow the workers to frequently warm their hands. Some possible methods include battery-operated hand warmers, contact warm plates or radiant heaters.

3. If the work involved presents the possibility of becoming wet through splashing, an **outer layer of clothing impermeable to water** should be worn.

4. If the ambient temperature is not excessively cold, but a low wind chill is present due to high winds, a **light windbreak jacket** will significantly reduce the potential for cold stress, without trapping excess perspiration.

5. Use of **steel-toed safety shoes** may become uncomfortable, as low ground temperatures are transmitted to the user's feet. It may become necessary to substitute alternative protective footwear, such as high impact plastic/rubber-composition footwear, during cold periods.

6. The insulation value of any clothing is determined by the quantity of still air that it can trap between the skin and the outside environment. **Many layers of light clothing are better than one or two heavy layers**. This is due to the many layers of trapped insulating air between each garment. Also, workers can shed layers as necessary, to maintain the optimum body temperature condition. The outer layer should be wind-resistant, and the layers should be capable of being vented at the wrist,

neck and waist to reduce wetting by perspiration (If worn during project activities on a hazardous waste site, however, this obviously may not be possible). Water and moisture (sweat) both reduces the insulating quality of clothing, and removes heat from the skin surface through evaporation.

Avoidance of extremely cold, windy environments is obviously the preferred method of avoiding hypothermia or frostbite. Try to preplan outside duties so that work is performed during the middle, warmest periods of the day. Dress appropriately - wear several layers of loose-fitting, lightweight, warm clothing. Trapped air between the layers is the best insulation, and layers can be removed to avoid sweating and subsequent chill. Outer garments should be tightly woven, wind resistant and water repellent, and hooded. Wear a hat because up to half of lost body heat escapes from the head. Protect the lungs from the entry of extremely cold air by wearing a covering (scarf, etc.). Mittens, snug at the wrist, are better than gloves. Above all, try to stay dry and out of the wind.

10.3 Work Procedures

1. To prevent contact frostbite, **bare skin to metal contact should be avoided** at absolute temperatures below freezing, 32° F (0° C). Metal tool handles should be covered by insulation. Or alternately, where fine manual dexterity is not required, insulating gloves may be worn.

2. Employees should take extra care when handling evaporative liquids (gasoline, alcohol, cleaning fluids, etc.) at air temperatures below 39.2° F (4° C). If these liquids are soaked into clothing or gloves, the subsequent rapid evaporative cooling can result in frostbite.

3. If work is performed continuously at or below a wind chill of 19° F (–7° C), a **heated shelter** (car, rest room, tent, office, etc.) nearby is required. Employees should be instructed to monitor and be aware of the onset of hypothermia and/or frostbite ⇐ *severe shivering, pain in extremities, excessive fatigue, or drowsiness* require an immediate return to the shelter. When entering the shelter, the outer layer of clothing should be removed, and the remainder loosened, to permit the evaporation of sweat. A change of dry clothing should be provided as necessary.

4. For work in environments below 10° F (–12° C) wind chill the following guidelines should apply:

   a. The buddy system should be implemented;

b. All site workers should be provided training on the information contained in the Procedure, with special emphasis on:

- Proper clothing practices
- Proper eating and drinking habits
- Recognition of impending frostbite and signs/symptoms of hypothermia
- Cold injury avoidance work practices

APPENDIX

COLD STRESS
H&S PROCEDURE #29

Wind Chill Chart

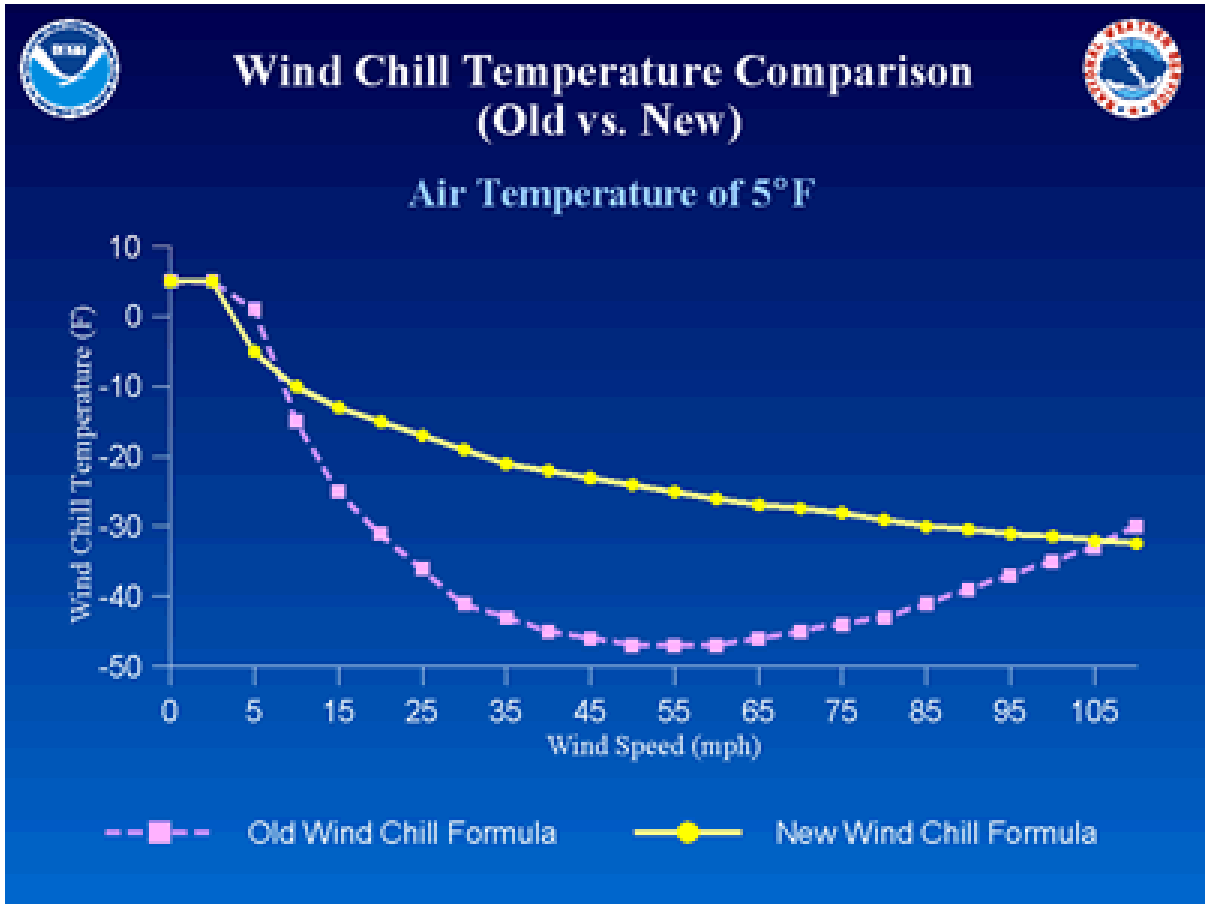
Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01


Wind Chill Temperature Comparison
(Old vs. New)
Air Temperature of 5°F
Wind Chill Temperature (F)
10
0
-10
-20
-30
-40
-50
0
5
15
25
35
45
55
65
75
85
95
105
Wind Speed (mph)
Old Wind Chill Formula
New Wind Chill Formula

1.0 OBJECTIVE

Biological hazards include snakes, spiders, mites, insects, noxious plants, bacteria, viruses, fungi, and any other living organism that can cause injury or illness. It is the objective of HDR to provide proper training and equipment to workers who may be exposed to biological hazards when conducting project-related field activities.

2.0 PURPOSE

The purpose of this procedure is to provide information to HDR employees to assist them in recognizing and avoiding biological hazards encountered at project work sites.

3.0 APPLICABILITY

This Procedure covers occupational exposure to biological hazards and applies to all HDR personnel. NOTE: Biological hazards associated with human body fluid contact are addressed in H&S Procedure # 8 - *Bloodborne Pathogens*. All employees, regardless of HDR Department, may be impacted by this program.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC) and project-specific Site Health and Safety Officer.

National Director of Safety. The Director of Safety shall:

- Periodically review the effectiveness of this program, identify any deficiencies, ensure that they are corrected, and
- Assist OSCs and project professionals, as requested, in the implementation of this Program.

Office Safety Coordinators. The OSCs will:

- Provide initial training on this Procedure to any impacted office staff, make sure that this Procedure is readily available in each office, and
- Interface with the Director of Safety regarding any biological hazards that have been discovered and need addressing.

Site Health and Safety Officers. The Site Health and Safety Officers will:

- Provide initial training on this Procedure to their impacted project staff, make sure that this Procedure is readily available, and
- Interface with the Director of Safety regarding any unsafe biological site conditions that have been discovered as necessary.

5.0 SOURCES OF BIOLOGICAL HAZARDS

Sources of biological hazards include insects, mites, arachnids, animals, plants, and microbial agents present in the air, water and soil. These hazards can cause a variety of health effects, including skin irritation, allergies, infections or illness. Due to the nature and location of many HDR project assignments, exposure to biological hazards is unavoidable.

This procedure provides information on the types of hazards that employees may reasonably be expected to encounter, the potential health effects associated with exposure, protective measures that should be taken to reduce risks, and actions to be taken by employees if an exposure or suspected exposure occurs.

6.0 DEFINITIONS

Feral – Refers to any formerly domesticated animal that is now living as a wild animal. They are particularly dangerous because (1) their appearance as a familiar pet causes people to assume they will act like one, and (2) former association with people often causes feral animals to act without fear of humans. Term most frequently applied to dogs and cats.

Necrosis – Pathological death of a living plant or animal tissue.

Pathogen – A microbial agent capable of causing disease in humans.

Vector – Carrier or transmitter of a pathogen.

7.0 INSECT BITES & STINGS

Noxious insects are ubiquitous, and will be encountered in a variety of outdoor project settings. Their presence in the field is temperature dependent – they are not present in the cold seasons. Table 1 presents descriptions and habitat information for various types of stinging or biting insects, as well as protective measures that can be taken to avoid injury. In addition to the information presented in Table 1, the following preventative measures should always taken to minimize the chances of experiencing an insect bite or sting:

- Do not wear perfumes or colognes when performing field activities as they often attract stinging insects.
- Use an insect repellent with N,N-diethyltoluamide (DEET) (unless prevented by medical sensitivity).
- Wear protective clothing (long sleeves, long pants, and gloves).

The two greatest risks from most insect stings are allergic reaction (which can be fatal) and infection. General guidelines to follow if you experience an insect sting are as follows:

- For bee stings, remove the stinger by gently scraping it out with a blunt-edged object, such as a credit card or dull knife. Don't try to pull it out; this may release more venom.
- For all types of stings, wash the area carefully with soap and water. Do this two to three times a day until skin is healed.
- Apply a cold pack, an ice pack wrapped in a cloth.
- Apply a paste of baking soda and water for 15 to 20 minutes.
- Over-the-counter acetaminophen products may reduce pain.
- Another remedies for pain and itching is to applying a small amount of household ammonia to the bite area. There are also over-the-counter products for insect stings that contain ammonia.
- Some over-the-counter antihistamines advertise that they alleviate pain/swelling.
- Any employee who receives multiple stings should seek immediate medical attention.
- **Any employee who knows that they are allergic to insect stings/bites should consult their own physician concerning the prudence of carrying self-administered anti-toxin injectable medicine.**
- A sting in the mouth or nose warrants immediate medical attention, because swelling may block airways. You should also seek emergency care if you see any of the following symptoms, which may indicate an allergic reaction:
  - large area of swelling
  - abnormal breathing

- tightness in throat or chest
- dizziness
- hives
- fainting
- nausea or vomiting
- persistent pain or swelling (over 72 hours)

8.0 Mite Infestations – Chiggers (aka "Red Bug")

The only mite that causes a real problem to field staff is the parasitic larvae stage of the harvest mite, *Trombicula alfreddugesi*, commonly referred to as a "chigger". These arachnids, related to spiders, ticks and scorpions, are virtually invisible to the naked eye, measuring only 1/16 of an inch in length. Chiggers feed on low vegetation, but need vertebrate (including humans!) tissue as a source of protein. Chiggers are very mobile, moving quickly onto passersby's feet. Once on a person's skin, chiggers will move to confined areas where the skin is thin and moist – ankles, wrist, behind the knee, thighs, groin, armpit or waistline. Sitting on mite-infested ground will frequently result in severe chigger attacks around the crotch and under the beltline. Contrary to popular opinion, chiggers do not burrow into the skin, but rather attach themselves to the opening of a hair shaft and inject saliva into the skin, which prevents blood clotting and liquefies tissue, on which the chigger feeds. The immediate skin area around the bite becomes inflamed (an allergenic reaction to the chigger saliva), with a hard white center. The inflamed tissue camouflages the tiny red chigger. The mite will remain in this area, feeding, from one-to four days, or until physically removed by washing. The bite area will redden (mild inflammation) and begin to itch (reaction to injected fluids) a short time following the initial bite. Sweat and heat increase the itching sensation. Symptoms are transitory, generally abating without treatment in about one week, with no long-term complications unless physical scratching of the inflamed area results in infection. In rare individuals, a high density of chigger bites combined with a hyper-allergenic response could require medical attention.

Chiggers are a real menace to HDR staff in the southern sections of the country, becoming active in the late spring, with chigger "bites" beginning in early June and reaching the most severe frequency around the 4th of July. Chigger populations are especially dense in old-field sucessional areas with high moisture and shade, where high (2-3 ft) annuals such as Queen Anne's Lace grow.

Another favorite plant species harboring chiggers is Sericia Lespedeza, grown to improve game bird habitat. They are sparsely present in forested areas. Most people report chigger bites to be the most irritating and long-lasting bites made by all the summer arthropod pests!

Removing clothes and washing immediately after field work will reduce the probability of chigger bites, as chiggers generally move about the body for some time before settling down to feed. A DEET-containing repellent sprayed around the ankles and waist will deter chiggers for a limited time. One folk remedy that alleviates the itching of chigger bites is applying fingernail polish over the red inflamed area. Clear top-coat polish is best; otherwise, you may appear to co-workers to be covered in measles!

Table 1

Stinging & Biting Insects & Mites

Organism	Description	Habitat	Problem	Severity	Protection
Hornet	One inch long with some body hair. Abdomen is mostly black. Many species.	Round, paper like nest hanging from trees, shrubs, or under eaves of buildings.	**Sting**. One nest may contain up to 100,000 hornets, which may attack in force at the slightest provocation.	Severe pain, allergic reactions similar to bees. Can be fatal.	Do not come near or disturb nest. If a hornet investigates you, do not move.
Mosquito	Small, dark, fragile body with transparent wings. From 1/8 to ¼ inch long. Actually a species of fly.	Wherever water is available for breeding. Common throughout arable U.S., very bad in North Central US, Canada and Alaska.	**Bites** and sucks blood. Itching and swelling result. Disease vector.	Can transmit encephalitis, malaria and other diseases. Scratching causes secondary infections.	Use plenty of insect repellant and wear gloves. Stay in windy areas. Topical application of toothpaste may relieve itching. Ultrasound devices or Vitamin B do not prevent mosquito bites.
Wasp	Very thin waist. Many species. Color can be black, yellow or orange with stripes.	Underground nest; also paper-like honeycomb nest in abandoned buildings, hollow trees, etc.	**Stings**. Some species will attack en masse if you disturb or even closely approach the nest.	Severe pain, allergic reactions similar to bees. Can be fatal.	Avoid Nest. Do not swat at them.
Bee	Variable in size and color, many species ranging in size from microscopic to Bumblebee. European Honey Bee most familiar. Has two pair of wings.	Hollow logs, underground nest, and old buildings.	**Stings** when annoyed. Honey Bee leaves venom sac in victim. The ripping away of the venom sac kills the individual bee.	If person is allergic, nausea, shock, and constriction of the airway can result. Death may result.	Be careful and watch where you walk. Cover exposed skin. Avoid areas where bees are swarming. Avoid wearing sweet fragrances and bright clothing. Move slowly or stand still when bees are swarming about you.

Organism	Description	Habitat	Problem	Severity	Protection
Flies	One pair of wings; Variable in size and color; some species microscopic (biting Midges), others (Horse flies) bumblebee size.	Variable, may range far from wetland breeding areas. Common around rural farmlands, swamps, very bad in northern latitudes (e.g., Alaska).	**Bites. Bloodsucking.** Black Flies, Horse flies and Yellow Flies, in particular, can be vicious biters.	Very painful bites. Often more inhibiting during daytime lowland work than mosquitoes.	Wear thick protective clothing. Use plenty of insect repellant.
Fire Ant	Small reddish to brown ant. Imported from South America. Identify by presence of large visible colony mounds. Mounds appear after heavy rains overnight in areas where presence was not suspected.	Rural or residential, prefers sandy soils, limited to southern US (VA, TN southward). Cold weather intolerant.	**Sting.** Highly aggressive, attacks en masse. Multiple stings almost always occur.	Severe pain, allergic reactions possible similar to bees. Can be fatal.	Avoid disturbing mounds; wear boots when in sandy, coastal plain habitats. Individual colonies can be eliminated (temporarily) with pesticide application.
Chigger	Microscopic parasitic mite larvae (not an insect)	Old fields with high weeds, especially abundant in stands of Sericea Lespedeza and Queen Anne's Lace. Common throughout, very common in SE.	Injects anti-clot fluid into tissue and feeds, causing redness, swelling and intense itching. Locates around top of ankles, waistline, under arms.	Not serious or fatal, but temporarily irritating, due to itching sensation. Allergenic response to injected saliva causes itch.	Avoid walking in high weed fields, cover exposed skin. Apply DEET. Tuck pants inside socks. Shower promptly. Application of clear fingernail polish over welt will decrease itching.

8.1 Diseases Transmitted By Mosquitoes.

8.1.1 West Nile Virus

West Nile Virus is a mosquito transmitted viral disease that causes a serious, potentially life-threatening inflammation of the brain in people, horses, many species of birds, and possible other animals. It spreads through the bite of a mosquito carrier, but there is no evidence that it can be spread from person to person or animal to person. Originally an African disease, it has recently spread to the United States and Europe, with the first U.S. case reported in 1999.

At this time, human infection is rare, and the most impacted animals have been birds and horses. However, by the end of 2002, human cases have been reported from all U.S. states east of the Rocky Mountains, plus California.

Most people who become infected with West Nile virus will either have no symptoms, or very mild ones. Symptoms appear 3 to 14 days following infection. The CDC estimates that 20% of those infected develop clinical symptoms. Symptoms include fever, headache, and body aches, occasionally with a skin rash on the trunk of the body and swollen lymph glands.

Rarely, however, the infection can result in severe and fatal illnesses. Symptoms of severe infection (West Nile encephalitis or meningitis) include headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, and paralysis. It is estimated that 1 in 150 persons infected with the West Nile virus will develop a more severe form of disease.

Prevention

- Be on the lookout for dead birds, as a biological indicator of the area presence of West Nile. While over 110 species of birds may contract the disease, Jays and Crows are particularly susceptible and may die in large numbers in an infected area. Report the observation of multiple dead birds in an area to your local health department, unless instructed not to do so.

- Avoid outside activity in these areas at dawn and dusk, the periods when mosquitoes are most active.

- Wear a DEET-containing repellent to minimize the possibility of a mosquito bite.
- Wear maximum protective clothing – long pants and sleeves, hat, etc. to reduce the available mosquito target areas on the body.

8.1.2 Encephalitis (General)

Encephalitis is a serious but very rare viral illness transmitted by a species of swamp breeding mosquito, which acquires the virus by feeding on the blood of infected wild birds. In most years, the virus is limited to these birds and bird-biting mosquitoes, but occasionally the virus is transmitted to other mosquito species known to bite humans and horses. The virus transmission by mosquitoes ends with the first heavy frost.

Encephalitis can affect the brain. The symptoms, which appear 5 to 15 days after being bitten, include high fever, headache, stiff neck and decreased consciousness. One in three infected individuals will come down with the serious disease, while in two-thirds the effects disappear and the victim recovers. Where serious symptoms appear, however, encephalitis is fatal in 30-50% of cases. Individuals with symptoms suggestive of encephalitis should contact a physician immediately.

8.1.3 Malaria

Malaria is caused by a protozoan parasite (*Plasmodium sp*.) that is transmitted from person to person by the bite of an infected female *Anopheles sp.* mosquito. These mosquitoes are present in almost all countries in the tropics and subtropics, and all 48 continental states in the U.S. Although thought to have been eradicated by the mid-1950s, recently several cases have occurred. The threat is most probable during **hot** summers.

While there is no vaccine, malaria can often be prevented by the use of anti-malarial drugs prior to, during, and after, traveling into malarial areas, and the use of personal protection measures against mosquito bites (e.g., use of mosquito netting over sleeping areas, application of insect repellent to exposed skin and to thin clothing). *Anopheles* mosquitoes bite during nighttime hours, from dusk to dawn. Therefore, anti-malarial drugs are only recommended for employees who will have exposure during evening and nighttime hours in malaria endemic areas. At risk HDR employees will be those traveling or working in tropical & sub-tropical foreign countries. Employees at risk should contact their

private physician about the need to begin an anti-malarial medical program.

Symptoms of malaria include fever, chills, headache, muscle ache, and malaise. Early stages of malaria may resemble the onset of the flu. Individuals who become ill with a fever during or after work in a malaria risk area should seek prompt medical attention and inform the physician of their recent travel history. Malaria symptoms can develop as early as 6-8 days after being bitten by an infected mosquito or as late as several months or years (dormancy) after departure from a malarious area, after anti-malarial drugs are discontinued. Malaria can be treated effectively in its early stages, but delaying treatment can have serious consequences.

9.0 SPIDER BITES

While all spiders are venomous, only the few listed here are capable of biting humans and pose a risk to field personnel.

9.1 Black Widow.

The black widow is a moderately large, glossy black spider with very fine hairs over its body that gives it a silky appearance. On the abdomen is a characteristic red, crimson or yellow marking in the form of an hourglass. Only the female is poisonous; the male, which is smaller, is harmless.

Black widow spiders can be found almost anywhere in the Western Hemisphere in damp and dark places. Favored haunts are woodpiles, tree stumps, trash piles, storage sheds, bathhouses, fruit and vegetable gardens, stone walls, and under rocks. When in structures, they will go to dark places like closets or garages. They are non-aggressive and bite only when roughly handled or sat on. A person bitten by a black widow spider may be unaware, since the bite may feel like a pinprick and go unnoticed. In about 30 to 40 minutes, the area of the bite will swell and pain appears.

If you have any reason to suspect you have been bitten by a black widow spider, go to the hospital emergency room. Symptoms include:

- a deep blue or purple area around the bite, surrounded by a whitish ring and a large outer red ring
- body rash
- muscle spasms, tightness, and stiffness
- abdominal pain

- headache or fever
- general "sick" feeling
- lack of appetite
- joint pain
- signs of infection around the bite (swelling and redness)
- pink or red urine

Black widow spider bites rarely result in death, but it's important to get medical attention as soon as possible. Wash the bite well with soap and water. If being transported, the victim should apply an ice pack to the bite to slow down the spread of the spider's venom. Try to elevate the area and keep still to retard the spread of venom.

If it's safe to do so, catch and bring the spider to the medical facility with you - this is important because it is sometimes hard to diagnose a spider bite correctly. The spider can be killed first; just be sure not to disfigure it so much that species identification is impossible.

9.2 Brown Recluse.

The brown recluse spider has long, skinny legs and is about one-half inch in length. Its entire body is brown, except for a dark mark in the shape of a violin on its head. Its poisonous relatives may be gray, orange, reddish-brown, or pale brown.

Brown recluse spiders are most commonly found in the Midwestern and Southern states, and they are usually found in dark places. In the outdoors, they inhabit piles of rocks, wood, or leaves. If they come inside, they will go to dark closets, attics, or basements. Brown recluse spiders are non-aggressive and bite only when disturbed.

The venom of the brown recluse causes a limited destruction of red blood cells, tissue necrosis and may cause other blood changes. The victim may develop chills, fever, joint pains, nausea, or vomiting. A person who gets bitten by a brown recluse spider may not notice it or may only feel a little prick. After about four to eight hours, the bite will start to hurt a little more. It might look like a bruise or might form a blister surrounded by a bluish-purple area. Without treatment, the local tissue will continue to die, and the discolored area will enlarge. Brown recluse spider bites rarely kill people, but the tissue necrosis can be disfiguring and lead to serious medical consequences.

If you have any reason to suspect you have been bitten by a brown recluse spider, seek immediate medical treatment. As with Black Widow bites, wash the bite well with soap and water, and apply ice to the area, elevate it, and keep it still. If safe to do so, bring the spider to the medical facility with you.

9.3 Tarantulas

A tarantula is a black, hairy spider about two to three inches long. They live in nests in the ground and are timid, avoiding contact with humans. Those found in the southwestern United States are not highly poisonous, but occasionally a victim will have an allergic reaction to the injected venom. Other tarantula species brought into the country in imported fruit shipments may have more toxic venom. Their bites may cause marked pain and local redness with swelling. Death from a tarantula bite is extremely rare.

If a person gets bitten by a tarantula, the bite will probably feel and looks like a bee sting, with pain, redness and swelling in the area of the bite. Because of the tarantula's weak venom, it's unusual to have severe reactions involving other parts of the body.

If you think you've been bitten by a tarantula, wash the bite with soap and water. Mix up some meat tenderizer and water, and rub the bite with a cotton ball that's been soaked in the solution. If you have no meat tenderizer, hold an ice cube against the bite.

10.0 SCORPIONS

Scorpions are brown arachnids, ranging in size from 1 to 8 inches long, with eight legs and a front pair of prominent lobster-like claws. U.S. species are less than three inches long. A scorpion's stinger, supplied by a pair of poison glands, is at the end of its long tail, which is curved upward and forward over the back. Scorpions prefer shaded dry places, and HDR field personnel may encounter them under fallen wood, rocks and junk piles. They are primarily nocturnal and are more active when it rains.

There are 1400 species of scorpions worldwide, and about 40 species are found in the Southern and Southwestern United States. Scorpions inject a neurotoxin, which attacks the nervous system. Most species of scorpions in this country inject a toxin that, while painful, is not especially dangerous to humans (although stings of the U.S. species *Centrureides sculpturatus* has proved fatal to young children, and is potentially fatal to adults). The sting results in localized swelling and discoloration, similar to a wasp sting, and, like other stinging animals, may sometimes cause serious allergic reactions. More severe reactions from the venom involving other parts of the body can also occur.

If you think you've been stung by a scorpion, seek immediate medical treatment. Because of the possibility of allergenic reaction, and the possibility that the sting was that of *Centrureides sculpturatus*, all scorpion stings should be treated by a doctor. Put an ice pack on the sting immediately to help retard the spread of venom.

11.0 TICKS

A tick is a tiny brown mite that attaches itself to the skin of a mammal, bird or reptile and sucks blood. Ticks range in size from 1 to 4 millimeters, but may greatly enlarge as they consume blood. There are hundreds of species of ticks, and they can be found almost everywhere.

Ticks inhabit woods or grasslands in various regions of the U.S. Lacking wings, ticks climb onto small bushes or tall grass usually close to the ground, and wait for an animal or person to pass near them. They are attracted by carbon dioxide, which is generated during respiratory exhalation. As a host animal or human passes by, they latch on to the skin with their legs, use their “nose” to secure themselves, and cut a hole into the skin by means of a pair of sharp mandibles that saw back and forth. Blood is then sucked into their abdomen until fully engorged, at which time they drop off. During the ingestion of blood, ticks may transmit any disease agent present in their system, causing the host animal, if susceptible, to contract the disease. Various species of U.S. ticks are vectors for serious human diseases (See Section 11.2). A person who gets bitten by a tick usually won't feel it; there may be some redness around the area of the bite, but no pain. Medical attention is generally not required.

11.1 Tick Avoidance and Treatment.

In areas where ticks are found, outdoor workers should take the following precautions to protect themselves:

- Wear protective light-colored clothing to prevent ticks from getting access to your skin. This includes long sleeve shirts that fit tightly around the wrist, and long-legged pants tucked into stockings or boots. The light color assists in seeing small ticks on your clothing.
- Use insect repellants that effectively repel ticks (such as those containing DEET), unless prevented due to sensitivity. Apply the repellent to pant legs, socks, shoes, and the skin.
- Always check for ticks on and under clothing after working in tick-infested areas. A daily total-body skin inspection greatly reduces the risk of infection

since ticks may take several hours to two days to attach to the skin and feed. Pay special attention to your head, back, neck, armpits, and groin area.

If ticks are found on your body, take the following actions:

- Carefully remove ticks found attached to the skin. Gently use tweezers to grasp head and mouth parts of the tick close to the skin as possible. Pull slowly to remove the whole tick. Try not to squash or crush them since this can squeeze ingested blood, contaminated with disease agents, back into your body.
- Wash affected area with soap and water or disinfect after removing ticks. This minimizes the possibility of having the puncture infected from tick excrement, which is known to harbor disease agents.
- Contact a doctor immediately if you have an illness that resembles Lyme disease or Rocky Mountain Spotted Fever (see Section 11.2), especially when you have been in areas supporting high tick populations.

11.2 Tick Transmitted Diseases

11.2.1 Lyme Disease

Lyme disease was first recognized in North America in 1975 when doctors discovered an unusual number of people with arthritis in the town of Lyme, Connecticut. The disease is caused by a bacterium, *Borrelia burgdorferi*, which resides in some ticks. In about 75 percent of reported cases of Lyme disease, the victims develop a rash around or near the tick bite usually within one week. In many cases, a peculiar, bright red, circular rash develops. It soon expands to form a ring-shaped "bull's-eye" that can grow to the size of a dinner plate. Often, however, a more mild, general rash appears anywhere on the body. The rashes fade after several weeks. Some victims, however, never develop a rash, yet experience more advanced symptoms of the disease.

Lyme disease is an occupational concern for HDR personnel who work outdoors in certain geographical regionssupporting dense populations of ticks. It affects people differently, often going unnoticed but may cause serious health problems in others. If this disease is treated at its onset, it's rare for there to be any permanent effects to a person's health. If left untreated, it can cause disability.

11.2.2 Rocky Mountain Spotted Fever

Rocky Mountain Spotted Fever affects about 800 people in the U.S. each year. The disease usually occurs in the eastern U.S. from New York to Florida, and from Alabama to Texas.

Disease symptomology typically appears 3 to 12 days following a tick bite. During the bite, a rickettsiae parasite is transmitted to the human victim, which causes the fever. The most common symptoms are fever, headache, rash, nausea and vomiting. If untreated, death, while rare, is possible.

There is no current vaccine for Rocky Mountain Spotted Fever. If you get a high fever, rash or nausea within two weeks of a tick bite, get immediate medical care.

12.0 SNAKES

Every state but Maine, Alaska and Hawaii is home to at least one of 20 poisonous snake species. A bite from one of these, in which the snake may inject varying degrees of toxic venom, should always be considered a medical emergency. Because victims can't always positively identify a snake, they should seek prompt care for any bite, though they may think the snake is nonpoisonous. Even a bite from a so-called "harmless" snake can cause an infection or allergic reaction in some people. Two groups of venomous snakes are native to the United States: pit vipers and coral snakes.

12.1 Pit Vipers

The pit vipers, belonging to the family Crotalidae, include rattlesnakes, copperheads and cottonmouths (a.k.a. “water moccasins”). While copperheads and rattlesnakes are fairly distinctive, the many species of harmless watersnakes are often mistaken for cottonmouths. Pit vipers all have a small "pit" between the eye and nostril that allows the snake to sense prey at night. Most are thick, heavy-bodied snakes, and have vertical pupils (like a cat’s) that are easily seen from a safe distance. They deliver venom through two long retractable fangs that swing outward when the mouth is opened. About 99 percent of all venomous snakebites in the U.S. are from pit vipers. Individual pit viper species vary in the toxicity of their venom. All inject a venom that is principally haemotoxic in nature – it destroys red blood cells and tissue. Some species -- Mojave rattlesnakes or canebrake rattlesnakes, for example—deliver a highly toxic venom dose. Copperheads, on the other hand, deliver weaker, less dangerous venom that sometimes may not require antivenin treatment. Refer to Appendix A for range maps of common pit vipers.

12.2 Coral Snakes

The other U.S. family of poisonous snakes is Elapidae, which includes two species of coral snakes, *Micrurus fulvius spp*. Coral snakes have a thin form and have small mouths with short fixed fangs, which give them a less efficient venom delivery than pit vipers. Because of their small mouths, fingers and toes are most frequently bitten and the bite is often difficult to detect.

Because of the coral snake's reclusive nature and docile temperament, coral snakebites are rare in the United States--only about 25 a year by some estimates—but if bitten, the snake's neurotoxin venom (affects the nervous system) is very dangerous. Several victims have experienced respiratory paralysis, one of the hazards of neurotoxin venom. Coral snakes inhabit the coastal plain regions of the southern U.S., from North Carolina through central Texas. The U.S. range of coral snakes is presented in Appendix A.

12.3 Non-poisonous "Mimics"

Some nonpoisonous snakes, such as the scarlet king snake *Lampropeltis triangulum elapsoides* and the scarlet snake *Cemophora coccinea*, mimic the bright red, yellow and black coloration of the coral snake and inhabit the same general range. This potential for confusion underscores the importance of seeking care for any snakebite (unless positive identification of a nonpoisonous snake can be made). Table 2 presents the field identifying characteristics of the coral snake and its mimics.

Table 2 – Identification of Coral Snake and "Mimics"

SPECIES	COLOR OF SNOUT	BODY PATTERN
Coral Snake	Black Snout	Red & Yellow body rings touch
Scarlet Snake	Red Snout	Red rings touch black rings
Scarlet King Snake	Red Snout	Red rings touch black rings

12.4 Snakebite First Aid

The bites of both pit vipers and coral snakes can be effectively treated with antivenin. But other factors, such as part of body bitten, time elapsed prior to treatment and care taken before arriving at the hospital, also are critical. The American Red Cross recommends the following first aid measures:

- Wash the bite with soap and water.

- Immobilize the bitten area and keep it lower than the heart.
- Get medical help.
- If a victim is unable to reach medical care within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow venom. The bandage should not cut off blood flow from a vein or artery. A good rule of thumb is to make the band loose enough that a finger can slip under it.
- A suction device may be placed over the bite to help draw venom out of the wound without making cuts. Suction instruments often are included in commercial snakebite kits.

Recommendations of **what not to do** if bitten by a snake include the following:

- **No ice** or any other type of cooling on the bite. Research has shown this to be potentially harmful.
- **No tourniquets**. This cuts blood flow completely and may result in loss of the affected limb.
- **No electric shock**. This method is under study and has yet to be proven effective. It could harm the victim.
- **No incisions in the wound**. Such measures have not been proven useful and may cause further injury.

Some bites, such as those inflicted when snakes are accidentally stepped on or encountered in wilderness settings, are nearly impossible to prevent. But the following precautions can lower the risk of being bitten:

- **Leave snakes alone**. Many people are bitten because they try to kill a snake or get a closer look at it.
- **Stay out of tall grass** unless you wear thick leather boots, and remain on hiking paths as much as possible.
- **Keep hands and feet out of areas you can't see**. Don't pick up rocks or firewood unless you are out of a snake's striking distance. (A snake can strike half its length.)
- **When turning over rocks or logs, always lift them towards your body**, thus shielding yourself from any snake hiding beneath.

- **Be cautious and alert when climbing rocks**, especially during early spring and fall, as venomous snakes will be moving to or from communal denning sites, and their local densities around these favored areas may be quite high.

If you encounter a snake when working, just walk around the snake. Give it a little berth, six feet is plenty, leave it alone and don't try to catch it.

13.0 ALLIGATORS (Information also generally applies to American Crocodile)

The American Alligator, *Alligator mississippiensis*, is a very common large reptile across the southeast U.S., ranging from Georgia to Texas, and especially Florida. It inhabits fresh water of any size and kind, from ditches and ponds to sloughs, marshes, rivers and reservoirs. In suburban areas they wander onto golf courses and into family swimming pools or conveyance canals.

This reptile grows to lengths in excess of 12 feet, and feeds on a wide variety of animals, including fish, turtles, ducks and any mammal that it can grasp, subdue and drag under the water and drown. Domestic dogs are an especially attractive prey item.

While human attacks are rare, given the frequency of human-gator contact, and humans are not normally viewed as a prey "item" by alligators, attacks do occur. HDR staff working in and around suitable gator habitat should take the following precautions:

- Never encourage the approach of alligators. Never, ever feed alligators, as it is illegal – they will eat almost anything, and once fed, will return for more handouts, quickly losing their fear of humans. Once this fear has subdued, they will begin to charge humans due to the association with food. This dooms the alligator to an eventual death, as "habituated" gators, like bears, they become a threat and have to be killed by authorities for public safety reasons.

- Never take any pet, such as dogs or cats, in a boat in alligator areas. Alligators won't view you as food, but the dog or cat certainly will be. Any pet jumping into the water will most certainly be attacked, and any boat or canoe capsized by the attack of a large alligator will throw the human occupants in the water along with the intended prey animals, and humans may be seized during the ensuing confusion.

- Don't walk dogs on the edge of lakes, rivers, canals, or ponds likely to harbor alligators – you are inviting attack by walking a "meal".

- Alligators spend a lot of time sunning on the banks of open water, and appear lazy, but are aware of intruders and can run very fast for short distances. Don't approach to look or yell, taunt, or throw anything in their direction.

- Female alligators make large nest mounds out of plant materials – don't knowingly walk on or around these.

- If an aggressive alligator is sighted, try to get GPS Coordinates or photos to document its location and call the local Fish and Wildlife Commission for handling or relocation.

14.0 BEARS

All species of bears are dangerous and should be avoided if possible. Specific guidance on the hazards of working around bears, and the actions to take if confronted by a bear are presented in Appendix B – *Working in Proximity to Bears,* of this Procedure, and should be referenced as pertinent to field operations.

15.0 OTHER ANIMALS

Employees conducting work at landfills, abandoned buildings, or urban project locations may encounter feral animals. Do not feed, chase, act threatening or call to these animals, or try to pet them. These animals should be left alone unless they interfere with project activities or act in an unusual or threatening manner; in this case, back away from the immediate area while facing the animal. **Feral dogs can become pack oriented, very aggressive, and represent serious risk of harm to unprotected workers**.

Avoidance and protection protocols include watching for animal dens, using good housekeeping to discourage foraging, and using repellents (visual-wear bright clothing, audio-announce your approach or presence with loud whistling, talking, radios, etc., and chemical – mace, etc.).

Animal transmitted diseases include rabies and hantavirus.

15.1 Rabies.

The major risk of rabies comes from contact with the saliva, body fluids, or tissue of infected animals. Animals that can be infected with rabies include all mammals, but in particular:

- wild mammals--primarily foxes, skunks, bats, and raccoons

- livestock--mostly cattle but occasionally horses, sheep, goats, and pigs

- domestic cats and dogs
- wolves, coyotes and other meat-eating mammals

15.1.1 Disease Progression

In humans, the incubation period (the time between initial virus contact and onset of the overt symptoms) is dependent on dose and species of animal vector, but generally ranges from two to eight weeks. In rare cases, it can vary from 10 days to 2 years. Rabies progresses through several stages. Initially, a person who is bitten may notice unusual feelings or tingling around the wound. Soon afterwards, there is a period of tiredness with lack of appetite, and usually accompanied by headache, fever, cough, sore throat, abdominal pain, nausea, vomiting, and diarrhea. A period of extreme worry, irritability, inability to sleep, and depression follows, possibly with hallucinations. "Furious rabies" may follow, for which the signs are strange behavior including biting other people. At this stage, victims have an uncontrollable fear of water. This is why rabies has sometimes been called "Hydrophobia." Alternatively, "Paralytic rabies" may develop where the muscles gradually become paralyzed, starting at the site of the bite or scratch. A coma slowly develops, with eventual death.

Workers who may have been exposed to rabies must never wait until they develop symptoms of the disease. Once the symptoms appear, the disease is almost inevitably fatal. It is important to recognize the signs of rabies in animals and take precautions immediately following bites, scratches, or other potentially infectious contact.

In **animals**, rabies appears in two different forms. It may appear as *furious rabies* in which the animal changes behavior, becomes restless, wanders aimlessly, and bites any animal, person, or object in its way. Eventually the animal becomes paralyzed in the throat and hind legs, and dies. Or it may appear as "*dumb rabies*" in which an animal changes behavior, becomes withdrawn or more affectionate, tries to hide, has difficulty swallowing, and dies after a few days without ever becoming violent.

All animals **do not** behave in the same manner when they have rabies.

- Foxes and skunks may lose their shyness and fear of people, pets, or livestock. Back away from any wild mammal that is acting unafraid.

- Cattle usually become restless and aggressive, bellow loudly, drool, may show weakness in the hind legs, and appear to be choking.
- Cats can often become extremely vicious.
- Dogs usually become excitable, wander aimlessly, and may be vicious and bite for no reason.

If an animal is threatening and dangerous and cannot be scared away, or is suspected of having rabies, withdraw, call 911, requesting the local police or animal control personnel, and continue to observe its movements (if possible). If an animal must be killed, try to avoid damaging its head. An undamaged brain is important for a rapid, accurate laboratory diagnosis. Do not handle the animal or carcass (but if necessary, for any reason, wear protective gloves, masks and goggles).

15.1.2 Action to Take if Exposed or Potentially Exposed

Workers who have come into contact with saliva, body fluids, or tissue of animals suspected of having rabies must take the following steps without delay:

- Immediately clean the wound with soap or detergent and flush the wound to full depth with water for several minutes. Washing the wound is probably the most effective procedure in the prevention of rabies. While this is being done, shield the eyes, nose, and mouth from spray from the wound.
- Apply a household antiseptic, 70 percent alcohol (ethanol), tincture or aqueous solution of iodine, or 0.1 percent quaternary ammonium compound such as benzalkonium chloride.
- Remove any clothing that may be contaminated, place it in a plastic bag properly labeled and wash it promptly and separately from other clothing.
- Call a doctor or hospital emergency room and contact the police, the local humane society, or a local veterinarian. If possible, provide the following information:
  - the name and address of all persons attacked or exposed to the animal's saliva, body fluids or tissues,
  - the time and place of the incident, and

- any other information to help find and identify the offending animal.

People who have had contact with the rabies virus require both the rabies immune globulin and the rabies vaccine as soon as possible. Only a single dose of rabies immune globulin is necessary. In previously vaccinated people, two doses of the vaccine are required after a biting incident, one immediately and another three days later.

15.2 Hantavirus

Hantavirus is a virus present in the urine, saliva, or droppings of infected deer mice, *Peromyscus sp.*, and some other wild rodents. Unfortunately, deer mice are very common and widespread across the continental U.S. Hantavirus causes a rare but serious lung disease called Hantavirus Pulmonary Syndrome (HPS). This disease is extremely serious since 50-60% of the people who get the disease die.

People can contract the Hantavirus infection through inhalation of respirable droplets of saliva or urine, or through the dust of feces from infected wild rodents. Transmission can also occur when contaminated material gets into broken skin, or possibly, ingested in contaminated food or water.

The disease begins as a flu-like illness. In the early stage, a worker may experience fever, chills, muscle aches, headaches, nausea, vomiting and shortness of breath. However, the disease progresses rapidly and infected people experience an abnormal decrease in blood pressure and their lungs will fill with fluid. Workers experiencing any of these symptoms within 45 days after their last potential exposure should seek medical attention immediately and tell their physician of possible Hantavirus exposure.

When working in areas where the disease has been reported, the following precautions should be taken to reduce the likelihood of exposure to potentially infectious materials:

- Avoid coming into contact with rodents and rodent burrows or disturbing dens (such as rat nests).
- When performing project work that requires entry into confined spaces, where obvious signs of rodent infestation are present, wear disposable gloves and a fit-tested respirator with HEPA filter to prevent inhalation of fecal dust (Reference HDR H&S Procedure # 9 – *Respiratory Protection*).

- Do not dwell in areas that are in proximity to rodent droppings or burrows or near areas that may shelter rodents or provide food for them (e.g., woodpiles, large supplies of birdseed).

- Keep food, birdseed, etc. in rodent-proof containers.

16.0 PLANTS

Toxic plants are found among trees, shrubs, vegetables, and vines. The largest number of plant poisonings occur from ingestion. However, the largest concern for HDR field workers comes from contact with plants that can cause a skin rash due to allergic reaction. Poison ivy, poison oak, poison sumac and wild parsnip are the most common plants that cause a skin rash.

16.1 **Poison ivy**, *Rhus radicans*, can be found in every region of the United States except the Southwest, Alaska and Hawaii. It grows in the form of a vine (and shrub in its early growth) along riverbanks, rocky fields, pastures, thickets, woods, and waste places and often climbs trees, fences, and dwellings. The plant is identified by having shiny green leaves grouped in threes, and the woody vine generates a proliferation of aerial rootlets, which resemble a reddish beard. The leaves turn red in fall. Another feature used to identify poison ivy is its small waxy globe-shaped, white, berry-like fruits. **All HDR field personnel should become familiar with the appearance of poison ivy!**

16.2 **Poison oak**, *Rhus diversiloba*, is found on the west coast (CA, OR, WA). Poison oak is a perennial shrub with slender stems, which are erect and woody, with one or a few erect branches. It does not climb nor does it have aerial roots. The leaves are similar in number (3), arrangement and coloration to poison ivy. The leaves are oblong (resembling oak leaves), are hairy on the top surface and velvety beneath. The fruit is a small pale green to whitish-tan berry. Poison oak grows in dry barrens, sandy wastes, pinewoods, and sandy woods.

16.3 **Poison Sumac** grows abundantly along the Mississippi River and swamps of eastern North America, but is far less common in other regions. It grows as a shrub to approximately 25 feet in height. Each stem contains seven to thirteen leaves arranged in pairs. The leaf and leaflet stalks are reddish with clustered whitish fruits, which resembles those of poison ivy. **In autumn, all three poisonous species produce whitish berries, whereas all other members of the Sumac family produce red berries (and are harmless).**

16.4 Exposure, Symptoms, and Treatment

Each of the plants described above contain an oil, which when in contact with the skin causes a rash. All parts of the plant contain this oil – leaves, vines and berries. This oil is present in the woody parts of the plant even in winter.

Not everyone is allergic to these plants, but immunity seems to be transitory – individuals may seem to be immune to the effects of poison ivy for years, and then suddenly develop the rash upon the next exposure. Exposure, and symptom development, can occur when they:

- Touch poison ivy, poison oak or poison sumac
- Touch clothing or shoes that have the sap on them
- Touch the skin or clothing of an exposed person
- Touch pets or animals that have the sap on them
- Come in contact with the smoke of these burning plants, or of logs that still have the poison ivy vine attached

Symptoms usually appear within several hours to 3 days of exposure, but may appear as long as 3 weeks later and include the following:

- redness and extreme itching are the first signs
- rash erupts on areas that were exposed, often in the pattern of streaks or patches consistent with where the plant touched the skin
- rash is in the form of red pimples and may form large, weeping blisters
- the worst stage of the rash is experienced four to seven days after exposure
- the rash may last for one to two weeks
- reactions can vary from very mild in some individuals to very severe in highly sensitive individuals, sometimes even requiring hospitalization

General first aid for exposure includes the following:

- The skin should be washed with soap and warm water as soon as possible following exposure. After ten minutes, the oils have penetrated the skin and cannot be washed off

- Scrub under the fingernails with a brush to prevent spreading of the oils to other parts of the body by touching or scratching
- Wash the clothing and shoes of the exposed person with soap and water. Oils can linger on these surfaces for several days
- Body heat and sweating can aggravate itching. Keep the victim cool and apply cool compresses to the skin
- Calamine lotion (not Caladryl) may be applied to the skin to decrease itching
- 1% hydrocortisone cream may be applied four times per day to relieve inflammation and itching
- In cases of severe or extensive rash, especially around the face or genitals, your physician may prescribe oral steroids

Call immediately for emergency medical assistance if:

- the rash covers more than one quarter of the body
- the victim is suffering a severe allergic reaction such as swelling and/or difficulty breathing or has had a severe reaction to a past exposure
- the victim is coughing following exposure to the smoke of burning plants

Call a physician if:

- the itching is severe and cannot be controlled
- the rash affects the face, lips, eyes or genitals
- the rash shows signs of infection such as pus, yellow fluid leaking from blisters, odor or increased tenderness

Prevention

Species identification and avoidance is the only truly effective preventative. All field personnel should learn to recognize poison ivy/oak, in two different habit's of growth - as a woody climbing vine, and as a free standing bush. Additionally, personnel should wear long pants, long sleeves, and gloves to minimize the possibility of exposure. **There are also barrier creams that, when applied to the exposed skin, offer good protection for a limited time, and have been used by field personnel with success**.

16.5 **Wild Parsnip**, *Pastinaca sativa*, is a noxious, non-native member of the mustard family that grows more than 5 feet tall and has a yellow, umbrella-shaped cluster of flowers. Common in the North Central US, the plant contains juices that when smeared on human skin and activated by the presence of natural sunlight, causes nasty chemical burns ("phyto-photo-dermatitis") about 24-48 hours after exposure. The sap contains photosensitive chemicals; unlike poison ivy/oak, there is apparently no natural immunity. The sap is lipid-soluble, meaning it is rapidly absorbed into the skin, so washing is effective only if done immediately after contact. However, the potency of the sap seems to diminish over time, so the exposed skins sensitivity to UV light appears to peak 30-120 minutes post contact.

In mild cases, the skin reddens and appears sunburned for a day or so. In severe cases, blisters form and eventually erupt. In some cases, may leave a brownish pigmentation that can persist for years.

Wild Parsnip grows in clusters, and aggressively invades soils found in roadside ditches and other areas of recent disturbance where the natural vegetation is spars or missing. Unlike poison ivy, just brushing against the plant doesn't produce the symptoms – you must get the crushed leaf or stem juice on your skin, and then it must receive direct ultra violet radiation found in sunlight. Cases may be misdiagnosed as poison ivy.

Like poison ivy, the only truly effective preventative is to avoid contact with the plant – learn what it looks like in all its growing stages, and beware open disturbed edge-habitat and pasture areas.

17.0 WATERBORNE PATHOGENS

Water-borne pathogens can be present in various types of water bodies encountered at project sites. Two more common water-related pathogens are *giardia* and *cryptosporidium*, which cause gastrointestinal illness when ingested. These microorganisms are present in human and animal fecal matter, and enter water-bodies through point and non-point sources. Combined sewer overflows may, during times of high rainfall, be a primary source of pathogens entering water-bodies. Runoff from ground spreading of septage, sludge and manure, as well as discharges from malfunctioning septic systems, may also be sources of these pathogens.

The most common means of contracting these pathogens is by drinking contaminated water, and through accidental ingestion while swimming and/or performing sewer inspection services (splash hazard). Avoidance consists of not drinking from, and minimizing body immersion into streams, lakes, ponds, etc., regardless of how clear the water may appear. If immersion is necessary, wear

waders and other appropriate apparel to prevent skin contact, and avoid hand-to-mouth contact.

18.0 AIRBORNE PATHOGENS

Several infectious diseases are transmitted through the air by inhalation of contaminated material - Legionnaires' disease, Valley Fever, and Histoplasmosis.

18.1 Legionnaires' Disease

The bacterium responsible for Legionnaires' disease belongs to the genus *Legionella*. There are approximately 35 Legionella species known to produce the disease. Legionella species are commonly found in any aquatic environment. They can survive for several months in a wet environment and multiply in the presence of algae and organic matter.

HDR employees most at risk from the disease are those with job assignments involving inspection of water cooling towers in air conditioning systems. The published literature suggests that some outdoor job assignments may additionally be at risk - where soil is disturbed by bulldozing, and areas where surface or aerosolized water discharge occurs.

Legionnaires' disease usually begins with a headache, pain in the muscles and a general feeling of unwellness. These symptoms are followed by high fever (up to 40°-40.5°C or about 104°-105°F) and shaking chills. Nausea, vomiting, and diarrhea may occur. On the second or third day, dry coughing begins and chest pain might occur. Difficulty with breathing is often reported.

The prevention of *Legionella* infection can be best achieved by good engineering practices in the operation and maintenance of air and water handling systems.

18.2 Valley Fever

Valley Fever is primarily a disease of the lungs that is common in the southwestern United States and northwestern Mexico. It is caused by the fungus *Coccidioides immitis*, which grows in soils in areas of low rainfall, high summer temperatures, and moderate winter temperatures. Resistant spores, produced by this fungus, become airborne when the soil is disturbed by winds, construction, farming and other activities. These spores are the infective agent.

Valley Fever is prevalent in the San Joaquin and Central Valleys of California, and in the hot, desert regions of southern Arizona (especially in the Phoenix and Tucson areas), southern Nevada, southern Utah, southern New Mexico, western

Texas (especially around El Paso), Mexico (in the states of Sonora and Chihuahua), and in semiarid and arid areas in Central and South America.

Employees with potential risk of exposure are those assigned duties involving disturbance of desert soils, particularly around rodent burrows, Indian ruins and burial grounds. In these settings, infections are more likely to be severe because of intensive exposure to a large number of spores. Exposure to windstorms or recently disrupted soils may increase the chances of infection. Valley Fever infections are more prevalent during certain seasons. In Arizona, the highest incidence of infection occurs during June and July, and October through November. In California, the risk of infection is highest from June through November, without the late summer break.

Valley Fever symptoms generally occur within three weeks of exposure. Most cases are very mild. It is thought that over 60% of infected people have either no symptoms or experience flu-like symptoms and never seek medical attention. Of those patients seeking medical care, the most common symptoms are fatigue, cough, chest pain, fever, rash, headache and joint aches. Some victims develop painful red bumps on their shins or elsewhere that gradually turn brown (the medical term for these is "erythema nodosum"). Since the common symptoms are not unique to Valley Fever, positive identification of Valley Fever as the cause of illness requires specific laboratory tests.

Otherwise healthy people generally have complete recovery within six months following the onset of Valley Fever. In about five percent of cases of Valley Fever, pneumonia results. In another five percent of Valley Fever patients, apparently benign lung cavities develop after their initial infection. These cavities occur most often in older adults, usually without symptoms, and about 50% of them disappear within two years. Occasionally, these cavities rupture, causing chest pain and difficulty breathing, and require surgical repair.

Of the Valley Fever patients that seek medical attention, one to two percent develops disease that has spread to other parts of the body. The most common site of dissemination is the skin in the form of lesions. Bones and joints (especially the knees, vertebrae, and wrists) are other frequent sites of dissemination.

18.3 Histoplasmosis

Histoplasmosis is an infectious disease of the lungs caused by inhalation of a fungus, *Histoplasma capsulatum*. The infection sometimes can spread to other parts of the body. *Histoplasma c.* thrives in moderate temperatures and moist environments. Droppings from chickens, pigeons, starlings, blackbirds, and bats support its growth. Birds are not infected with it because of their high body

temperatures, but they can carry it on their feathers. Bats can be infected and can excrete the organism in their droppings. The symptoms of the infection appear within 5 to 18 days after exposure, most commonly in 10 days. There are five different forms of infection, as follows:

- **Asymptomatic** is when the victim does not show any symptoms and is unaware of the infection.
- **Acute disseminated** involves short-term affects to organs other than the lungs. It is usually confined to young children and is marked by fever, cough, exhaustion and enlargement of the liver and spleen.
- **Acute benign respiratory** is produced by a heavy exposure and marked by weakness, fever, chest pains, and cough. The severity of the symptoms depends upon the magnitude of the exposure.
- **Chronic disseminated** is of long duration (chronic) and it involves other organs outside of the lungs. It occurs in people with a reduced capacity to fight disease, such as patients with leukemia and persons being treated with drugs that suppress the body's immune system. The chronic disseminated form is marked by fever, anemia, hepatitis, pneumonia, inflammation of the lining of the heart cavity, meningitis, and ulcers of the mouth, tongue, nose and larynx. Disabling.
- **Chronic pulmonary** occurs in persons with pre-existing lung diseases such as emphysema. It resembles tuberculosis and is more common in males over 40 years of age.

Most patients who develop histoplasmosis do not require treatment. Some may only require supportive treatment that relieves the symptoms of the disease. Severe symptoms with a large involvement of the lungs require treatment with specific antifungal drugs.

HDR employees at potential risk for exposure are those whose job duties involve contact with soil enriched with bird and bat droppings. Prevention of histoplasmosis relies on avoiding exposure to soil/dust in a contaminated environment. Spraying with water is advisable to reduce dust.

Decontamination with 3% formaldehyde has been shown to be effective. However, formaldehyde solutions should be used with caution since this chemical may cause adverse health effects following inhalation, ingestion, or skin or eye contact.

Persons working in known contaminated areas should use protective clothing such as gloves and coveralls, and a respirator equipped with a high efficiency particulate air (HEPA) filter (for spore-laden dusts). If formaldehyde is concurrently applied, a HEPA combination cartridge, suitable for also absorbing formaldehyde vapor may be required. For major soil clean up operations of prolonged exposure, a Powered Air Purifying (PAPR) or supplied air respirator (ASR – airline or SCBA) may be necessary. Refer to HDR H&S Procedure #9 - Respiratory Protection, for information on these respirators.

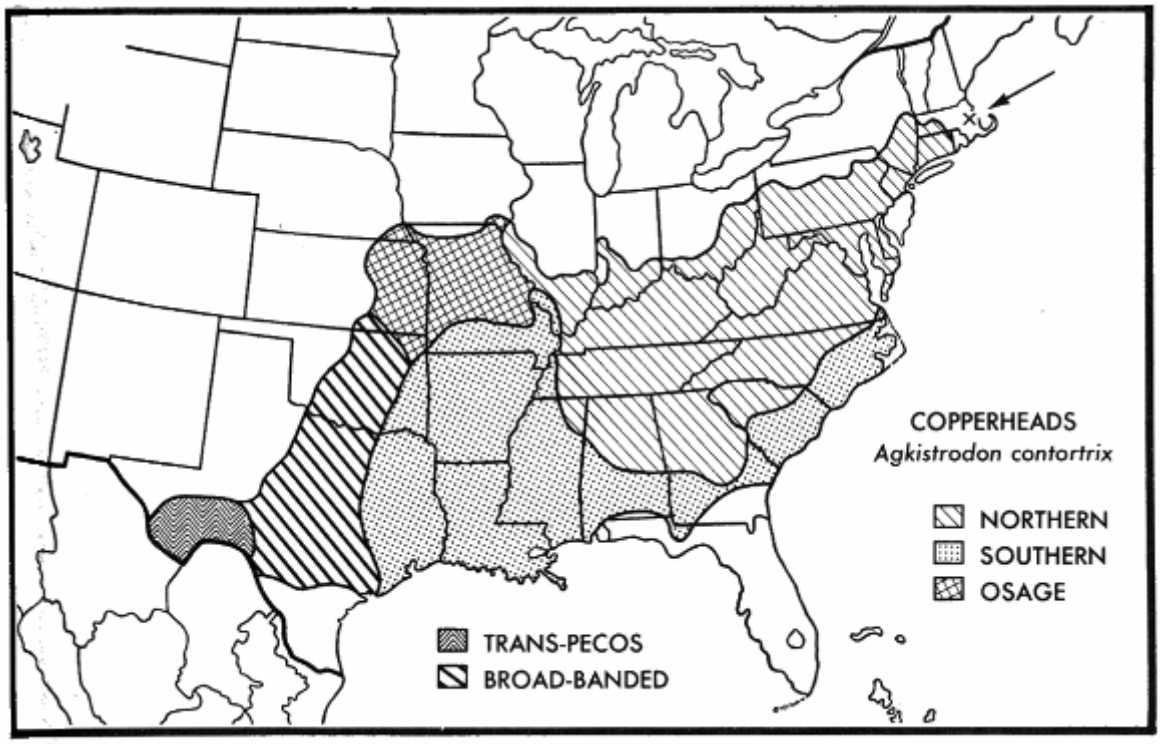
19.0 SOIL PATHOGENS

19.1 Tetanus

Tetanus is a bacteria common in soil and can infect the cells in open wounds. Any open skin that comes into contact with tetanus spores from the soil can become infected. Symptoms of tetanus include the following:

- Violent muscle spasms,
- "lockjaw" spasms of jaw muscles which keep the mouth from opening,
- difficulty breathing

Immunization is the best way to prevent tetanus. Immunization is generally given in childhood and should be repeated every 10 years throughout adulthood. Booster shots can be given to trauma victims who are at risk of having been exposed. If any HDR employee suffers a puncture wound, they should complete an accident report and consult with the HDR physician (see HDR H&S Procedure #35 – *Medical Monitoring*) regarding the prudence of receiving a tetanus booster.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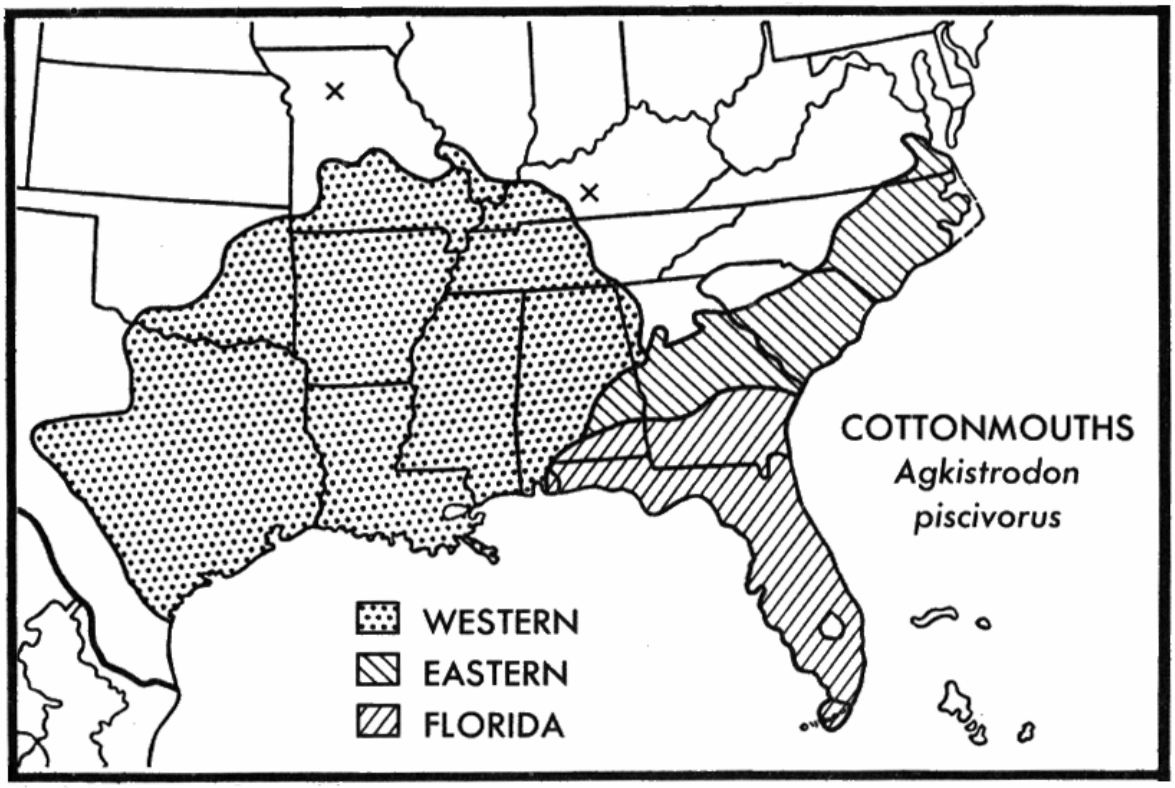
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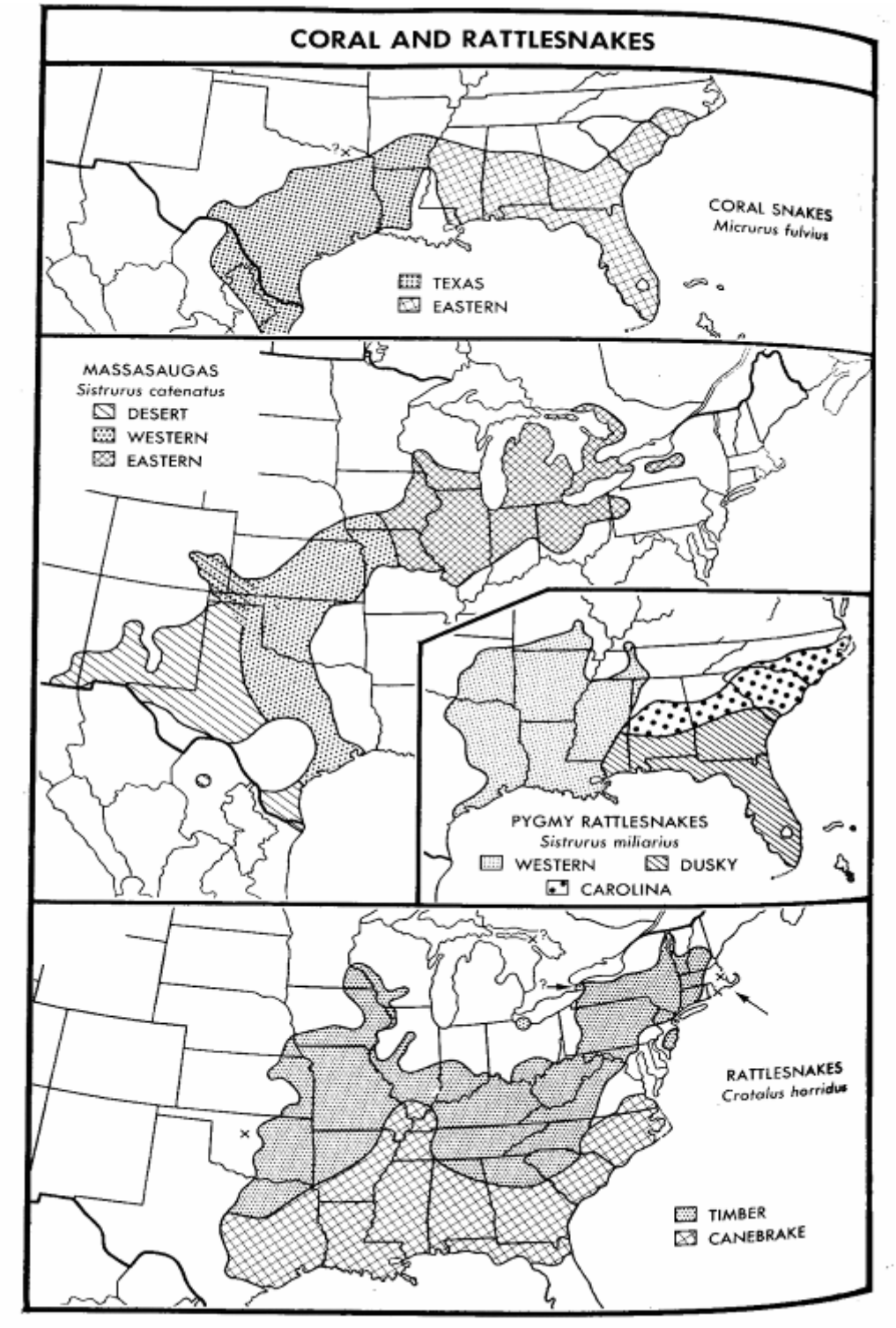
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Sistrurus catenatus
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PYGMY RATTLESNAKES
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CAROLINA
RATTLESNAKES
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TIMBER
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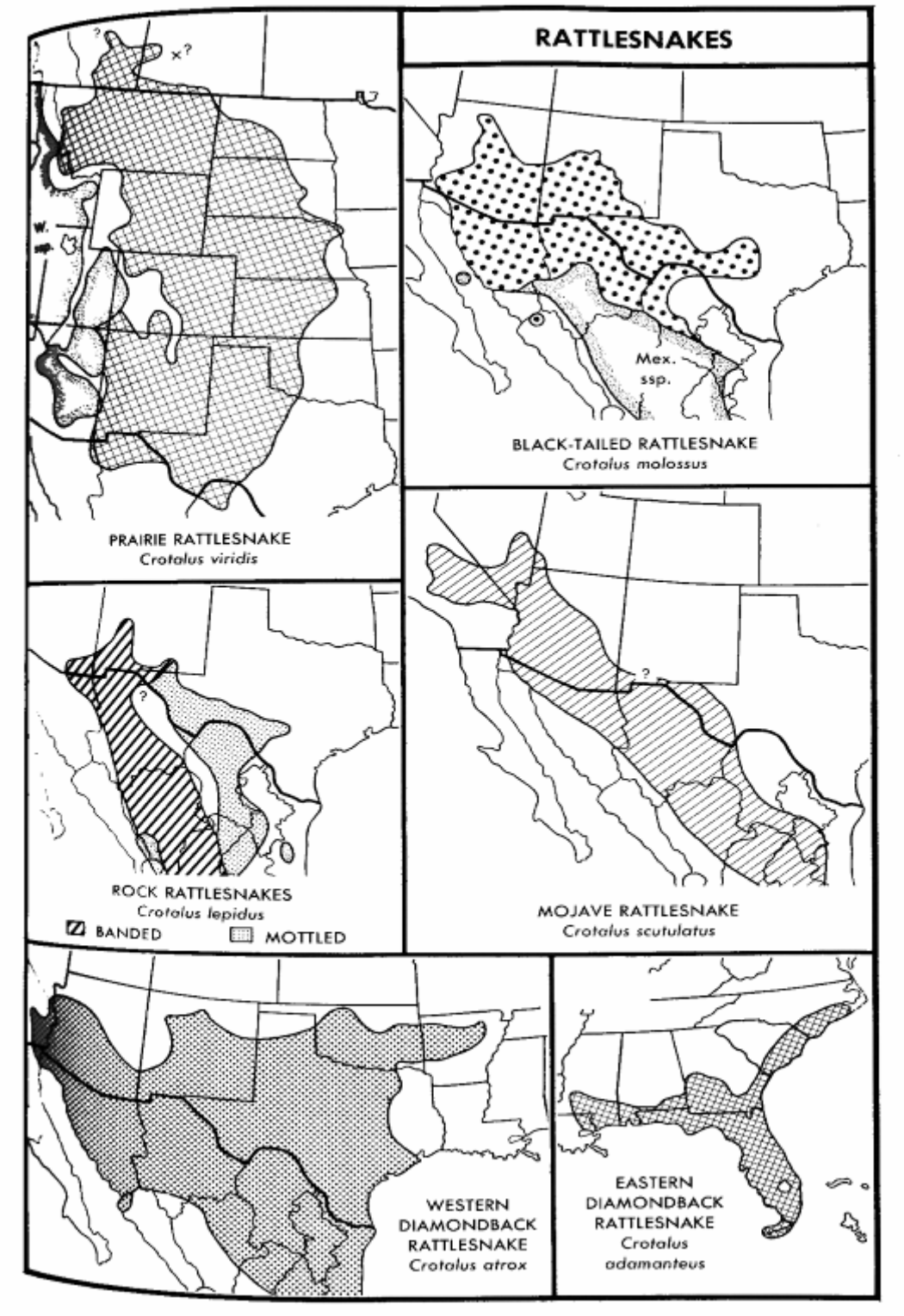
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BLACK-TAILED RATTLESNAKE
Crotalus molossus
Mex. ssp.
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Crotalus lepidus
BANDED
MOTTLED
MOJAVE RATTLESNAKE
Crotalus scutulatus
WESTERN DIAMONDBACK RATTLESNAKE
Crotalus atrox
EASTERN DIAMONDBACK RATTLESNAKE
Crotalus adamanteus

Working in Proximity of Bears

This addendum is applicable to HDR employees who perform work in areas where bears may be present in medium to high densities such as Alaska, Canada, and northern and western regions of the United States. Employees required to work in these regions should be trained to work safely in bear country and be positively protected against a bear attack.

1.1 Bear Characteristics

Brown (including Grizzlies) and black bears are the two species of bears expected to be encountered most often by HDR employees while working in the United States and Canada.

Characteristic	Black Bear, *Ursus americanus*	Brown Bear ("Grizzly"), Ursus arctos horriblis, Ursus arctos middendorffi
Color	Black, brown or bluish gray	Dark blonde to brown to black
Muzzle Markings	Tan or brown	None
Face profile	Straight or "Roman"	Slightly concave
Average Weight Female	100 to 250 lbs.	250 to 600 lbs.
Average Weight Male	200 to 400 lbs.	600 to 1000 lbs.
Average Shoulder Height	3 Feet	5 Feet
Average Standing height	6 Feet	9 feet
Claws	Short, curved	Long and straight
Other		Pronounced hump between shoulders

1.2 Bear Activity Patterns

Bears leave their dens in April or May and begin their search for food which may be scarce during the spring months. Mating, which typically occurs from mid-May through the end of July creates movement of the bears throughout their home ranges. During this period, if one bear is observed in the area, there is a good chance that another bear is nearby. During the summer months the bears tend to localize near food sources such as ripe vegetation and streams. In the Fall, bears tend to move between food sources such as areas with ripe berries and well stocked Salmon rivers. In late fall the bears begin to prepare dens for winter hibernation. During hibernation, bears may still react quickly if they are disturbed.

1.3 Bear Behavior

Bears typically exhibit predictable behavior regarding humans, opting to avoid humans unless forced to react when they feel threatened, startled, or required to protect their food or young. Bears spend much of their time feeding and will protect their food sources from other bears, animals and humans. NEVER disturb a feeding bear.

Bears will also react to new situations in their environment and if scared off initially, may return to investigate. Bears are social and non-territorial; however they will defend their personal space if threatened. Also, bears are often not aware of their surroundings if focused on food trails or looking for mates and may blunder into an unsuspecting person. For these reasons HDR employees must be aware of their surroundings at all times when they are working in bear country. Specific examples of what to be aware of include:

- Wind direction. Traveling with the wind at your back allows bears to smell you and leave the area prior to your arrival.
- Noise. Areas with high background noise levels such as along streams do not allow bears to hear you approaching until it becomes startled by your appearance.
- Smells. Odors such as dead/rotting animals (e.g., moose carcass) may indicate a bear in the area protecting its food.
- Visuals. Torn up insect-infested logs, fresh scat, or fresh tracks may indicate the nearby presence of a bear.

1.4 Bear Communication

Bears will often use threats and displays of action as an alternative to fighting.

- Subordinate displays – moves away, sits or lies down
- Dominant displays – approaches by walking or running, typically with ears cocked forward
- Head and mouth actions – carries head high as it circles the adversary, dropping head and beginning short series of short open-mouthed lunges showing aggression
- Flattened ears – about to make contact

Although a bear standing on its hind legs has commonly been considered a threatening display, it is often a non-threatening action where the bear is just trying to get a better look at its surroundings.

Bears also use vocalizations to show apprehension and an agitated bear may salivate and yawn.

- Black bears – low guttural noise, blowing sounds
- Brown bears – low level vocalizations, popping sounds

1.5 Bear Reactions to Human Encounters

An encounter with humans may trigger threat displays or may be predatory in nature.

Threat Displays may include:

- Communication such as huffing, panting, hissing or growling
- Looking at you directly with lowered head and ears laid back
- Turning sideways to display its size
- Walking with stiffened front legs
- Charging to within 4 to 5 feet then stopping suddenly or veering to the side
- Slapping one or both front feet on the ground or swatting vegetation; or
- Jaw popping by rapidly opening and closing its mouth

Some threats will lead to a charge intended to make physical contact while others may end with the bear walking or running away.

Predatory Behavior:

Although unprovoked bear attacks on humans is very rare, a few cases have been cited where the bear considers humans to be potential prey and stalks or attacks them. The predatory behavior does not trigger threat displays but rather the bear makes a direct approach at a fast walk or run, follows or circles you. The predatory bear shows no fear, but rather an intense interest.

1.6 General Bear Safety Training

Standard industry bear safety training should be provided for any employee required to work in bear country, especially in areas where bears are present in medium to high densities. The training should include an introduction to bear behavior, biology and body language, bear avoidance, use of deterrents, and bear encounter scenarios including how to react in case of an attack.

An awareness level video titled *"Staying Safe in Bear County"* presented by the Safety in Bear Country Society (in co-operation with the International Association

for Bear Research and Management) is available through the HDR Anchorage office. Many live instructor courses are also available in Alaska, Western Canada, and in the lower 48 United States. Courses may be found in listings on the Internet or by contacting local agencies, such as the U.S. Forest Service.

1.7 Protection from Bears

HDR employees should be positively protected from a bear attack while working in bear country by the presence of trained personnel carrying either (a) firearms capable of stopping an attacking bear or (b) an industry accepted chemical bear deterrent, i.e., Bear Spray. Under no circumstances, should an HDR employee work alone in bear prone areas.

The method of positive protection chosen for each project will vary depending on the project location, type of work, bear population and risk of attacks, project logistics, and the client's policies and procedures. It is recommended that the method of protection be chosen prior to the project start and that this choice and all associated requirements be communicated to all team members and the client. This will help to ensure that all employees affected by the decision are aware of and agree with the method selected.

A "Bear Guard" should be assigned to accompany a group of workers for any field work performed in medium to high density bear areas, where the number of workers and/or the worker experience is not adequate to provide the positive protection needed. The designation of "Bear Guard" is assigned only to trained individuals whose sole responsibility is to provide positive protection against bears for the group of workers they are accompanying. HDR employees, whose primary responsibility is to perform field work, are not considered "Bear Guards" even if carrying a firearm or bear deterrent.

The project manager or team leader is responsible for verifying that the assigned Bear Guard is competent to perform the job duties through completion of the required firearm safety course and any additional training course completion, past experience or certification by an independent third party.

All bear guards, whether HDR or third party, must be included in their employer's random drug and alcohol testing program. All third party bear guards must have passed a pre-employment drug and alcohol test prior to serving as bear guard for HDR personnel.

1.8 Firearms and Bear Guarding

Firearms may be carried by HDR employees, an independent third party, or the client; whoever is carrying the firearms shall have successfully completed the following:

- A formal training class (and refresher training, as required) on firearm safety, sponsored by the National Safety Council, National Rifle Association or other nationally recognized safety organization, and has provided a copy of the training records to the project manager or OSC for retention. (HDR Anchorage staff recommends that Bear Guards trained through the "Learn to Return" program receive a minimum rating of 3 to be eligible for a "Bear Guard" position); and

- A formal training class on bear awareness and response, sponsored by a recognized organization in the field of bear safety.

HDR employees must also review and demonstrate compliance with HDR Procedure #31, Firearm Safety.

1.9 Firearm Recommendations

The choice of weapon and ammunition combinations for protection against bears should be based on each carriers experience with firearms and comfort with weapon size, weight, and recoil. Weapon type and size in combination with ammunition should be tested prior to use in the field to ensure that the carrier can accurately shoot the weapon in an attack situation with confidence.

Guidance on weapons and ammunition should be obtained during bear safety training. Additional resources include the Alaska Department of Natural Resources, who recommend a minimum of a 12-guage shotgun or .300 magnum rifle, and the United States Department of Agriculture document, *Safety in Bear Country: Protective Measures and Bullet Performance at Short Range. (1983)*

1.10 Bear Spray

HDR encourages each individual to carry a bear deterrent such as pepper spray when working in bear prone areas. The spray canister should be carried in a holster on a belt, shoulder strap or pack to allow quick response if needed.

Caution must be used when discharging the spray to make sure that the individual is upwind from the spray to avoid exposure to the irritating and possibly disabling effects of the deterrent. Training for the use of Bear Spray should be obtained through bear safety classes or live training presented by experienced HDR employees.

Please note: Bear Spray products are considered hazardous materials for ground and air common carrier transport. Each product should be handled according to applicable regulations and transportation providers should be alerted about its presence. Prior to shipping Bear Spray, contact Lonnie Fredrickson, HDR Mailroom Supervisor, @ (402) 399-1245 for manifest preparation. Privately commissioned air transport does not fall under the air common carrier regulations and therefore does not require a formal manifest.

1.11 Personal Protective Equipment

All employees should wear orange or orange/yellow vests when working alongside a team member or Bear Guard who is carrying a firearm, and during any hunting seasons that are occurring near the project area.

Since bear attacks are sudden and without warning, it will probably not be possible to install ear hearing protection prior to the discharge of a weapon. In the case that it is essential, it should be of a type that can be worn at all times (allows passage of normal frequency sounds) while performing the bear guard service.

1.12 References and Resources

"Staying Safe in Bear County" presented by the Safety in Bear Country Society (in co-operation with the International Association for Bear Research and Management)

U.S. Department of Agriculture, *Safety in Bear Country: Protective Measures and Bullet Performance at Short Range*, General Technical Report PNW-152, 1983.

National Audubon Society, *Living in Harmony with Bears,* 2000.

Herrero, Stephan, *Bear Attacks – Their Causes and Avoidance*, Nick Lyons Books, New York, NY, 1985.

Smith, David, *Backcountry Bear Basics, A Definitive Guide to Avoiding Unpleasant Encounters*, The Mountaineers, Seattle WA, 1997.

"Learn to Return" Training Systems, Inc., Anchorage, Alaska

1.0 OBJECTIVE

This procedure addresses the hazards associated with the use of mobile drilling equipment, and the safety requirements to be implemented to avoid these hazards. Although it is not anticipated that HDR employees will ever operate mobile drilling equipment, HDR employees may often work near or with drilling teams and are exposed to the associated hazards. Several other HDR Health and Safety Procedures may also be pertinent and should be reviewed by HDR employees when working on these sites. These include:

HDR H&S Pro #3	Slip, Trip and Fall Protection
HDR H&S Pro #4	Electrical Safety
HDR H&S Pro #9	Respiratory Protection
HDR H&S Pro #12	Fall Protection
HDR H&S Pro #20	Hazardous and Toxic Waste
HDR H&S Pro #21	PPE

2.0 PURPOSE

The purpose of this procedure is to ensure the safety of HDR personnel when working near mobile drill rigs. **Activities in many States are regulated by State OSHA plans, which may have certain requirements which differ, and are more stringent than, the requirements presented here. When performing services in these State plan areas, HDR will comply with the State promulgated OSHA regulations (reference the HDR Corporate H&S Program, Part 1, Section 8.0, for a listing of the State Plan States).**

3.0 APPLICABILITY

The HDR Drilling Operations Safety Program implemented in this Procedure applies to all HDR personnel at HDR project sites. This program will impact all employees, regardless of HDR Department.

4.0 PROGRAM IMPLEMENTATION

This program will be administered nationally by the HDR Director of Safety and locally by the Office Safety Coordinator (OSC).

4.1 **National Director of Safety**. The Director of Safety shall:

- Periodically review at least annually, the effectiveness of this program, identify any deficiencies, and ensure that they are corrected; and assist OSCs and project professionals, as requested, in the implementation of this Procedure and regulatory interpretations.

Project Manager (PM). The Project Manager will:

Determine if any project will require the use of a mobile drill rig, and verify that all field personnel scheduled to work in proximity to the rig operation have read this procedure, and understand it's contents.

Office Safety Coordinators. The OSCs will:

Provide initial training on this Procedure to their respective office staff who work on drilling sites, make sure that this procedure is readily available in each office, and interface with the Director of Safety regarding any unsafe office or project site conditions that have been discovered, and need addressing or interpretation.

5.0 DEFINITIONS

Cathead - A smooth drummed winch used to raise the drill string or drop hammer by hand wrapping the lifting rope around the spinning drum.

Catline - The rope that is wrapped around the cathead to provide a means of lifting loads.

Cribbing - A system of timbers, arranged in a rectangular pattern, used to support and distribute the weight of equipment.

Drilling Fluid - Fluid that is pumped into a drilled hole and used to wash cuttings from the hole.

Drilling Mud - Drilling mud is a type of drilling fluid made of clay and water slurry which is used to coat and support the sides of the drill hole and seal off permeable strata.

Hammer - 140-pound weight, dropped 30 inches, which generates the force that drives the sample tube into the soil.

Float - The bearing pad at the end of the rig support leg. The float distributes the rig weight over a larger surface area, and should sit level on the ground.

6.0 SAFE PRACTICES FOR RIG OPERATION

The drill rig operator always has the primary responsibility for rig safety and maintenance. While it is not anticipated that HDR personnel will ever serve as drill operators, it is important to understand the **safety equipment** that the drill rig should be equipped with, and the **safe operational practices** that should be employed by the rig operator. Whenever HDR personnel work around mobile drill rigs, it is important that they attend a safety meeting with the drill rig operator, where personnel responsibilities and safety features of the drill rig are explained. **It is the responsibility of all HDR employees to stay clear of all moving parts!** Although HDR employees do not have direct responsibility for safe rig operation, if potentially unsafe conditions are observed the HDR employee shall immediately move to a safe location and immediately advise the drill rig operator of the reason for the relocation. If, in the opinion of the HDR employee, the unsafe condition is not corrected adequately, the HDR employee shall document the potentially unsafe condition using the *Potentially Unsafe Condition Report*, provide the original copy of the report to the senior drilling supervisor on-site, and contact the HDR Project Manager for resolution with the drilling company and/or client. The following are drill rig safety features and safe operation practices that should be followed by the drill rig operator:

- Before being placed into service at a site, a competent person, normally the rig operator, should **conduct an inspection** of the rig in accordance with the manufacturer's requirements. The manufacturer's operating manual should be kept with the rig, and available for reference, at all times.

- All drill rigs should be equipped with at least one emergency shutdown device, (two, if working on a U.S. Army Corps of Engineers project) often called the "**kill switch**." Typically, this will either be a red push button, or a line that can be pulled to stop the rig. The kill switch should be tested at the beginning of all rig operations.

- Prior to starting or engaging equipment, the operator should **verbally alert** employees and **visually ensure** employees are clear from dangerous parts of equipment.

- The **operating area around the auger** must be kept free of obstructions, soil cuttings, drill fluids, and tools.

- All **guards** and safety devices must be maintained and in proper operating condition and configuration.

- **Fire extinguishers** shall be maintained on or near drill rigs for extinguishing small, incipient stage fires.
- Before a drill rig is positioned to drill, the area on which the rig is to be positioned should be cleared of removable obstacles and vegetation and the **rig should be leveled**. The mast should not be raised until the rig has been leveled.
- Outriggers, if used, shall be extended per the manufacturer specifications.
- Hoists should be used only for their intended purpose and not loaded beyond rated capacity. If the hoist appears to be straining to lift a load, due to friction or weight, HDR personnel shall clear the area.
- Loads should be picked up by the hoists slowly to prevent kickout hazards.
- When using the “Cathead”, the operator must be positioned attentively at the rig controls. This device and the associated rope ("catline") present **entanglement hazards**. Care must be taken to ensure that the user and adjacent personnel do not become entangled and that hands are kept clear of the winch.
- Catlines should only be used on a revolving cathead. Wire rope is susceptible to kinking and wears grooves into the cathead, so should never be wound around the cathead. Loads requiring more that six turns around the cathead should not be lifted by this means.
- Only natural fiber (e.g., hemp) rope should be used with the cathead, since synthetic rope will melt when overheated.
- The cathead should not be used when the rope is wet (rain) since wet natural rope tends to grab or stick on the cathead drum, causing the operator to lose control of the hammer.
- Auger guides shall be used when drilling through hard surfaces. Controls, such as a water spray, should be employed if excessive dust is being generated.
- Drill rod tool joints shall not be made up, tightened, or loosened while the rod column is supported by a rod slipping device.
- The discharge of drilling fluids from the borehole shall be channeled away from the work area to prevent slipping hazards and ponding of water.

7.0 SAFE PRACTICES FOR WORKING ON A DRILLING TEAM

- HDR employees should employ the following safe work practices whenever working as part of a drilling team or near mobile drill rigs:
- Never wear loose-fitting clothes or have long hair exposed that could get caught in moving parts.
- Keep the work areas and walkways clear of obstructions to provide unimpeded access and egress and eliminate tripping hazards.
- Drilling in streets, parking lots or other areas of vehicular traffic requires definition of the work zones with cones, warning tape, etc. and compliance with local requirements. All HDR personnel working on or immediately adjacent to a roadway shall wear orange safety vests with reflective striping.
- Work should cease and HDR personnel should seek shelter during **lightning storms, severe weather and extremely high winds.**
- HDR Personnel are prohibited from climbing onto the drilling mast at any time.
- Drilling and associated activities often require the use of bagged material (e.g., bentonite, concrete, gravel, etc.). When manually handling these materials, proper positioning and lifting techniques must be implemented to minimize the potential for strains and sprains.
- Cap and flag open boreholes.
- If methane or other flammable/explosive gases are suspected in the area, a combustible gas instrument (CGI) shall be used to monitor the air near the borehole. All work must stop, and the hole ventilated, if the CGI indicates flammable gas concentrations at or above 10 percent of the Lower Explosive Limit (LEL).

8.0 BURIED AND OVERHEAD UTILITIES

The location of overhead and buried utility lines must be determined before drilling begins, and the locations should be noted on boring plans. When working near overhead power lines, the drill rig mast should not be raised until the distance between the rig and the nearest power line has been determined and the utility company has been contacted to determine the voltage in the line. If overhead electric lines are not to be deenergized, minimum clearance distances in accordance with HDR H&S Procedure 4 -

Electrical Safety must be followed. The drill rig operator or assistant should walk completely around the rig to make sure that the overhead equipment does not have the capability of coming within the required clearances. Be aware that hoist lines and power lines can be moved towards each other by wind; additional clearance should be maintained to guard against this possibility.

9.0 SAFE HANDLING OF DRILL STEM AND AUGERS

- Never place hands or fingers under the bottom of an auger flight or drill stem when hoisting the augers or rods over the top of another auger or drill stem in the ground or other hard surfaces, such as the drill rig platform.
- Never allow feet to get under the auger or drill rod while they are being hoisted.
- When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- Move auger cuttings away from the auger with a long-handled shovel or spade; **never use hands or feet**.
- Never clean excess soils from an auger attached to the drill rig unless the transmission is in neutral, the engine is idled down, the auger has stopped rotating and the operator is stationed attentively at the controls.

10.0 OPERATION OF HIGH-PRESSURE WASHERS

High-pressure washers are often used in conjunction with environmental drilling operations for decontamination operations. Whenever operating high-pressure washers, whether HDR owned, rented or property of separate entity, HDR employees should review and comply with the operating manual for the unit. Additionally, the following safety rules apply when using high-pressure washers:

- Before use, the operator should inspect the pressure washer, the hoses and the lance to ensure that all equipment is in acceptable operating condition. The operator should carefully inspect the relief device to ensure proper functioning.
- No modifications can be made to the equipment except those authorized by the manufacturer. **Do not modify the lance!** The lance barrel, from trigger block to the tip, should not be less than 48 inches as recommended

by manufacturers of hydroblasting equipment. This is to prevent the operator from inadvertently directing the lance at himself. The lance must always be pointed at the work area and never at the operator or other personnel. Additionally, HDR employees should only use lances made of seamless stainless steel (identify by shiny surface free of corrosion). Do not use lances made of carbon steel, which can corrode and result in weakening of the lance.

- The operator should ensure that the work area is free of slip, trip and fall hazards and maintain good footing at all times.
- The operator must have an assistant to aid in moving the hose to different areas and backing up the operator. The assistant must remain behind the operator at all time, should monitor the operating pressure and be ready to shut down the equipment if necessary.
- Non-operators should remain at least 25 feet from the operator.
- The operating pressure should never exceed that which is necessary to complete the job.
- Equipment should be cleaned often to avoid oil or dirt build-up, especially around the trigger and guard area.
- Always increase pressure slowly to inspect for leaks. All leaks or malfunctioning equipment must be repaired immediately or the unit taken out-of-service.
- A serious risk of infection and further complications is possible from a hydroblasting laceration. If an injection injury is suspected, the injured employee must be examined or treated by a physician or other licensed health care professional.

11.0 PERSONAL PROTECTIVE EQUIPMENT

When working near mobile drilling equipment or any rotating machinery, jewelry and loose fitting clothing should not be worn. The following personal protective equipment (PPE) listed below should be worn by HDR employees **at all times** while engaged in drilling activities.

1. Hard hat
2. Safety goggles or glasses with sideshields

3. Safety boots with steel toes

4. Appropriate work gloves

Additional PPE may be required depending on the hazards present at the site. The following additional PPE that may be required and the conditions that may warrant their use:

- Orange safety vests with reflective striping, when exposed to traffic hazards.
- Personal flotation devices, when on or near water where the potential for drowning exists.
- Respiratory protection, when exposed to inhalation hazards.
- Chemically resistant clothing, when exposed to dermal hazards associated with chemical contact.
- Barricading and/or fall protection devices, when large diameter borings are being drilled and the potential exists for personnel falling into and being engulfed in the borehole. Where fall protection devices are used, precautions must be taken to ensure entanglement hazards are not increased. During boring operations, the in-place auger may be used to prevent personnel from falling into the hole.

When using high pressure washers, the following additional PPE is mandatory:

- Goggles and a face shield.
- Heavy duty PVC rain suit or equivalent.
- Heavy chemical resistant gloves.
- Hearing protection.

12.0 WORKING ON HAZARDOUS SUBSTANCE/WASTE SITES

When working around drill rigs on hazardous waste/substance sites, chemical and respiratory protective equipment is often required. When utilizing this equipment, a heightened level of awareness must be exhibited. For PPE use, the following considerations must be addressed:

- Use of loose fitting over boots especially those with “flap-over closures” (i.e., Tingley’s) should be avoided or flaps secured.

- Loose fitting gloves should be avoided.
- Where any of the above cannot be avoided, the loose clothing should be taped down to reduce the hazard.
- Use of respiratory protective devices reduces the field of vision and increases the exertion required to perform the work. Additional care must be exercised to ensure safe operations.
- Use of airline-Level B PPE impedes the ability of personnel and introduces an additional entanglement hazard. Precautions must be implemented to ensure that these hazardous are properly managed.

13.0 TRAINING

All HDR employees will be trained prior to working on drill teams or working in close proximity to mobile drill rigs, via a safety meeting to be held with the drill rig operator prior to the commencement of drilling activities. This training should include the following elements:

- The operation, inspection and maintenance of the equipment;
- The safety features and procedures to be used during the operation, inspection and maintenance of the equipment (including the location of all kill switches), and
- Overhead electrical line and underground hazards.

Additionally, HDR employees who are engaged in working on drill teams or in close proximity to mobile drill rigs shall be informed of the existence of this Procedure, and be provided an opportunity to review the Procedure prior to field mobilization.